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AGRICULTURAL ENGINEERING

Volume 14 MAY 1933 Number 5

A Study of Mechanical Corn Pickers[1]

By Claude K. Shedd[2]

THE research work on which this paper is based is being conducted at Ames, Iowa, under cooperative agreement between the U.S.D.A. Bureau of Agricultural Engineering, of which the author is the local representative, and the Agricultural Engineering Section of the Iowa Agricultural Experiment Station under the leadership of Dr. J. B. Davidson and E. V. Collins. These corn picker studies are part of a general investigation of corn production equipment and methods.

As an introduction to the subject, it is worth while to consider the present status of the use of mechanical pickers in production of corn. In the central and western parts of the corn belt a very large part of the crop is harvested by picking the ears from standing stalks in the field. Machines designed to do this work have been on the market for the past 25 years.

Early corn pickers were single-row, horse-drawn machines with the mechanism driven by ground drivewheels. Later small gasoline engines were mounted on some of the pickers to drive the mechanism. Still later the machines were arranged to be tractor-drawn and to have the mechanism driven by a power take-off.

In the fall of 1928 a considerable number of two-row corn pickers were sold to farmers. These machines are tractor-drawn, or mounted on the tractor, and the mechanism is driven by a power take-off. Machines of this description are manufactured by several of the large implement companies. They were sold in considerable numbers in 1929 and 1930 to farmers in the central part of the corn belt where the fields are fairly level and where corn yields are high.

BIG BULK OF CORN PICKING STILL DONE BY HAND

But today, after a quarter-century of development of this machine, the big bulk of corn picking is still done by hand. This is the only important operation in grain crop production which continues to be generally done by hand rather than by machine methods.

There are several reasons for this condition. Hand picking of corn is drudgery for most men past 50 years of age, particularly if the work has to be done in bad weather, but for a strong young man hand picking is reasonably fast and not particularly distasteful. Results of a man's work can be readily measured. This has served to introduce a spirit of contest in the work, thus taking the mind of the worker off of the physical discomforts and inspiring him to develop skill so that he can excel his neighbor in the amount of work he can do per day or per hour. In recent years, corn husking contests have been developed into sporting events that have attracted great crowds and attained wide publicity. But the fact remains that corn picking by hand is such hard labor as to tax the strength of all but the more vigorous, and the work must often be done under weather conditions causing the worker rather severe discomfort.

On the larger farms hand picking of corn always required hiring extra help. Many farm families have come to enjoy a measure of privacy in their homes due to the use of machinery to displace hired hands. Such families find it distasteful to take itinerant laborers into the family circle during the corn-husking season. One farm woman stated to me very positively that she prefers to work in the field helping her husband operate the picker rather than do the work and suffer the inconvenience of rooming and boarding extra men.

A FORM OF DRUDGERY NOT LIKELY TO BE RETAINED

So much for what might be called the human factors that influence farmers in the decision between hand and machine methods of corn picking. We may now consider for a moment the economic factors. The early single-row pickers did not greatly increase the output per man although they did remove some of the hardships of the work. Prior to the World War it was doubtful if any corn picker on the market ordinarily saved dollars for the owner. In the period of high wages after the war, great impetus was given to machine methods. Machines placed on the market during that period, particularly the two-row machines, when used under reasonably favorable conditions, proved to be money-makers for the owners; that is, the cost of harvesting was less for machine work than for hand work at the prevailing rates of wages. Under present conditions, lower wages have reduced the cost of hand picking below that of machine picking. It is of course impossible to predict how long wages will remain at this low level. However, I feel safe in predicting that eventually economic considerations will dictate the use of machines for picking corn just about as generally as machines are now used for harvesting small grains. Even if wages stay down to present levels, somebody may have the ingenuity to devise a machine that will do the work at a still lower cost. It is not logical to expect that this one piece of drudgery will be retained in agricultural practice very long after other kinds of hard, disagreeable hand labor have been mechanized.

We may now turn to a brief discussion of the characteristics of the machines themselves. The principal reasons for the comparatively small distribution of corn-picking machines are to be found in the failure of the machines to perform as required under all conditions. A great deal of progress in the development of mechanical corn pickers has been made during the past decade, but further improvement is necessary before they will be entirely satisfactory. The designers have had to meet a great variety of difficult conditions in corn picking. One engineer stated to me that it is just as difficult to devise a really satisfactory corn picker as it is to devise a practical cotton picker. I would not undertake to say that his statement was overdrawn.

The important difficulties with which farmers have to contend in using corn pickers may be outlined as follows:

1. A corn picker represents a considerable investment, a two-row picker costing more than twice as much as a 7-foot grain binder
2. Corn pickers are heavy machines, the two row picker weighing 1½ to 2 tons

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[1]Paper presented at a meeting of the Power and Machinery Division of the American Society of Agricultural Engineers, held at The Stevens, Chicago, November 1932.

[2]Agricultural Engineer, Bureau of Agricultural Engineering, U. S. Department of Agriculture. Mem. A.S.A.E.

3. Corn pickers leave too much of the crop in the field, particularly under adverse conditions. This is by far the most serious fault of the machines.

The purpose in conducting the corn-picker tests at Ames has been to get some accurate records of performance of these machines under a variety of conditions. It was thought that such records would furnish a sound basis for determining the best manner of using the machines and indicate the proper direction of efforts to improve them.

Two series of tests have been made. The first of these consisted of recording the performance of several different machines working in the same field under conditions as nearly the same as possible. It was thought that, in addition to the general value of the performance data, something might be learned by a comparison of the records made by different machines. These tests were of a duration of 4 a for each machine in the 1931 tests, and of 3.44 a per machine in the 1932 tests. We may call this series "machine performance" tests.

The second series of tests, which we call "timeliness" tests, was for the purpose of comparing the effect on machine performance of different conditions as found at different times of day and on different dates throughout the corn-picking season. These tests were each of short duration and were repeated a good many times with the same machine on different dates.

MACHINE PERFORMANCE TESTS

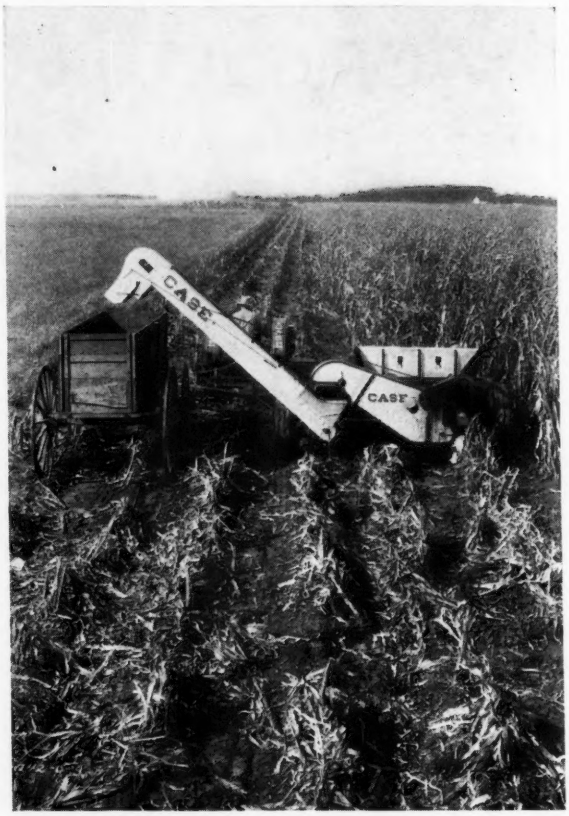
The tests for machine performance data were made in late October and early November, when the corn was in the most favorable condition for machine picking. Before each test sample areas were counted to determine the number of ears on standing stalks, the number of ears on down stalks (that is, stalks broken or leaning so that the ears touched the ground), and the number of ears blown off and lying loose on the ground. In 1931 the corn was not in very favorable condition; about 20 per cent of the stalks were down, a good many stalks having been broken by heavy wind. These broken stalks were dry and brittle, whereas the standing stalks were full of sap because there had been no killing frost up to November 2. In the 1932 tests the stalks were in condition, at least as good as average.

As to the number of stops during the test, the data indicate that in 1931 a good deal of difficulty was experienced in operating the machines. This was because of the unusual condition of the stalks, as just explained. There was very little trouble in operating the machine in 1932.

Data on the time required to change the wagons which were trailed to receive the corn as husked, show that, to uncouple from a full wagon and couple to an empty, took about 1½ min in the 1931 tests, which was about 10 per cent of the time in operation. Coupling to an empty wagon was a two-man job, but operating the picker was only a one-man job. This indicates that improvement is needed in wagon hitches. In the 1932 tests, seven wagon changes were made in 4 min and 17 sec with one of the machines, which was less than 40 sec per change. This was done by the machine operator alone, with an experimental one-man wagon hitch which was designed and built at Ames for this test.

The data on the rate of work is of special interest. In 1931 it would have taken about eight or nine average hand pickers to harvest corn as fast as a machine. In 1932 it would have taken 10 to 15 average hand pickers to keep up with a machine.

The most important data secured in these tests are those on field losses, which were determined by carefully gleaning sample areas. Counts were made on those areas of the ears on standing stalks, the ears on down stalks, and the ears loose on the ground; loose ears were picked up and weighed before the machine was used. After using the machine, both ears and shelled corn were carefully gleaned and weighed. The final results are best expressed in percentage of yield. Total gleanings varied in 1931 from 9.1 to 19.3 per cent of the yield, and in 1932 from 11.5 to 15.7 per cent of the yield.



These field losses are a good deal larger than users or makers of these machines would expect. The losses in 1931 were thought to be larger than for an average year, but in 1932, when the condition of the corn was about normal, the field losses averaged nearly as large as in the 1931 test. Of particular interest is the loss of shelled corn left on the ground, which varied in these tests from 1.1 of 5.88 bu per acre. This variation was due largely to difference in condition of the corn. When the corn is well matured early in the season and the ear shanks are still tough, it seems to be impossible to adjust the snapping rolls to eliminate excessive shelling.

Cleanness of husking has received a good deal of attention from designers. When husks are damp or tough the machine will do a cleaner job of husking than is generally done by hand. When husks are dry the machines leave a good many husks on the ears. This spoils the looks of the job to some extent, but from a practical standpoint there is apparently no great disadvantage in a considerable quantity of dry husks left on the corn when it is put into a crib, particularly if the corn is dry.

TIMELINESS TESTS

The following observations may be made concerning the data from the timeliness tests:

Effect of Time of Season. Comparison of field losses on successive dates shows a steady increase in total losses from October 31 up to December 22, when testing ceased because of deep mud and snow. This increase was due mostly to ears blown off and found loose on the ground. There was no material increase of losses other than in loose ears.

The losses in the tests made in February were so high, varying from 33 to over 50 per cent of the yield, that the use of the machines was entirely impractical.

Effect of Time of Day. Machines were tested both in the morning and in the afternoon on November 5, November 13, and December 15. November 5 was the only one of these days when there was enough drying during the day to make a decided difference between morning and afternoon conditions. Three machines were tested morning and afternoon on these dates. Contrary to common opinion as to usual experience, the field losses were not materially higher when the corn was dry in the afternoon than when damp in the morning.

The timeliness test data are of particular interest to the users of corn pickers, as they show that the machines work best early in the season. This fact is already well known, but users do not yet appreciate the extent to which field losses increase later in the season. It probably would be advantageous to shorten the corn-picking season and finish the work earlier than is now customary.

CONCLUSIONS

The most important fact thus far developed by these tests is the high rate of field losses of all the machines tested. Out of forty separate tests made in 1931 and the early part of 1932, there were only three in which the field losses were less than 10 per cent of the yield. The lowest record was 8.31 per cent and the highest 54.1 per cent. In nearly all of the tests the losses were between 10 and 20 per cent of the yield.

The high rate of field losses in the 1931 tests may be explained as due to storm damage to stalks. In the 1932 tests the stalks were in good condition and we expected lower field losses. They were about the same, however, in the 1932 as in the 1931 tests. We found that the corn shelled more easily in 1932. Field losses of shelled corn increased so that they just about offset the reduced loss of whole ears. Even if the losses shown in these tests are somewhat more than would be experienced in an average season, still they indicate a serious shortcoming of the machines. As now designed, these machines have established a definite but limited place for themselves in corn production. We can hardly expect that corn pickers will come into general use, until they are perfected so that field losses will be no greater with the machine than with hand picking.

The basic design of corn pickers as to location and arrangement of gathering points, gathering chains, and snapping rolls is practically the same for all makes of pickers now on the market. It is uncertain whether or not the details of this design can be improved so as to reduce field losses to an acceptable amount. Probably the greatest obstacle in the way of such improvement is the difficulty in saving corn that is shelled by the snapping rolls. Perhaps the problem will be solved by improving the details of existing basic design, or possibly it will be by discarding conventional design and incorporating some entirely new ideas.

The Effect of Corn Plant Characteristics on Mechanical Corn Picker Loss

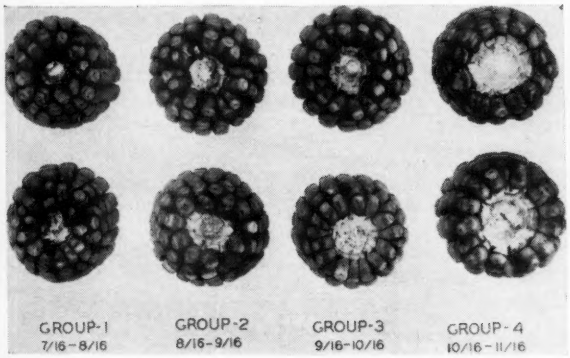
By R. H. Wileman[1]

DURING the four years of our mechanical corn production studies at Purdue University, one of the fields covered by this project has been used for studies of hybrid and open-pollinated corn.

In harvesting the corn from these fields the first two years it was found that the checks on mechanical picker losses showed a much smaller loss than in fields where the variety of corn regularly grown on the farm was raised.

This immediately raised the question as to what was causing the difference in picker loss as there was very little difference in types of soil between the fields, and the corn was picked under practically the same weather conditions.

[1]Experimentalist, machinery for corn borer control, Purdue University.



This shows the variation in ear shank diameter found in the mechanical corn production studies at Purdue, and also the four groups into which the corn varieties studied in 1932 grouped themselves

Endeavoring to answer this question the different strains and varieties in the hybrid field were harvested separately in 1931[2]. As each plot consisted of four rows across the field, the two center rows were harvested and kept separate, yield weights from a known area being taken. The average ear shank diameter at the point of breakage was determined for each variety from a random sample of corn from each plot which was taken at picking time. The picker loss was checked by picking up the corn left by the picker on the two center rows of each plot on which the yield weights were taken, thus enabling a loss percentage for each variety to be determined. These losses were then compared to the average ear shank diameter for the plot giving results as shown in Table I.

This study was continued in 1932, and 31 four-row plots of dent corn were grown. Adapted strains of corn consisting of nine open-pollinated strains and 22 hybrids known to vary in height of ear, length of ear shank, and ear shank diameter were selected. The open-pollinated strains were adapted to, and normally mature sound corn in, the vicinity of Lafayette. The hybrids used in the experiment were made from inbred lines which had been selfed for eight years.

[2]Acknowledgment is made to R. R. St. John, associate agronomist, division of cereal crops and diseases, U. S. Department of Agriculture, for furnishing the hybrid seed for these tests, assisting in the yield check-up and furnishing data on moisture content, test weight, and shelling percentage.

Table I. Relation of the Ear Shank Diameter to Resulting Picker Loss and Corn Yield, 1931

Average ear shank diameter between	No. of plots in group	Average yield, lb per acre	Average yield, bu per acre	Average picker loss, per cent
6/16 - 7/16"	12	3023	40.3	5.55
7/16 - 8/16"	22	2983	39.7	5.12
8/16 - 9/16"	7	3479	46.4	3.84
9/16 - 10/16"	6	3739	49.8	1.68

Hybrids are quite uniform in plant growth and breed true for certain characters. This remarkable uniformity was found to be an advantage in grouping the different strains into classes for a detailed study of mechanical corn picker losses. Some hybrids remain erect until harvest while others have a tendency to lodge. High-eared hybrids can be planted adjacent to plots of low-eared strains for comparative study. In these trials hybrids with short shanks and upright ears were grown in plots next to strains with long shanks and drooping ears.

Competition between strains was eliminated by harvesting only the center two rows of each four-row plot for record. The day before the harvesting of the corn was started, counts were made and notes taken on 200 hills from each plot as to the percentage of down stalks, average ear height at the lowest point, length of ear shank, and whether the ears stood up or hung down.

As the corn was picked the two center rows of each plot were kept separate and weighed, thus giving the yield for each plot. The picker loss was determined by picking up the corn left by the picker on these two rows in each case. A 50-pound moisture sample was taken during harvest from each of the 31 plots. Each sample was dried and yields were calculated on a uniform moisture basis of 17.5 per cent (No 3 corn).

The average ear shank diameters at the point of breakage, the test weight, and the shelling percentage were determined for each of the 31 plots.

A study of the corn plant characteristics indicates that there is a definite relationship between the ear shank diameter and the picker loss. A similar relationship is shown between the percentage of down stalks and the picker loss. A comparison of the ear shank diameter and percentage of down stalks points out that they are quite closely allied and that the average for a group based on either of these characteristics shows this relationship. This is borne out by the results as shown in Table II. These data point out a tendency for the ears with large ear shank diameters to be borne lower on the stalk although there is a wide variation among individuals within any group. When the ear height is compared separately with the picker losses there is but little relation found.

It thus appears that the average ear shank diameter is the most logical basis for comparison as these data show it to be a major factor in the resulting mechanical picker loss. The relation of the ear shank diameter to the yield is also quite definitely pointed out in both the 1931 and 1932 results as shown in Tables I and II. Another reason for its selection as a basis for comparison is that it can be readily determined for each individual ear. This can be done when the seed is selected either from the field or crib, or when it is being shelled.

Table II. Relation of Ear Shank Diameter to Resulting Mechanical Corn Picker Loss, Corn Yield, and to Other Corn Plant Characteristics

Average ear shank diameter between	No. plots in group	Average lb required per bu, 17.5% moisture	Average yield, bu per acre	Per cent down stalks	Average ear height	Test weight	Average picker loss, per cent
7/16 - 8/16″	7	78.2	71.4	21.10	26.1	59.0	3.85
8/16 - 9/16″	10	79.7	69.4	20.62	26.9	58.7	3.65
9/16 - 10/16″	6	77.6	75.6	12.55	22.7	58.2	2.92
10/16 - 11/16″	8	80.0	79.6	11.72	21.8	57.9	2.06

Taking the average ear shank diameter as a basis for comparison and dividing the varieties or strains into groups having 1/16-in variation in average ear shank diameter, the picker loss, corn yield, percentage of down stalks, pounds required per bushel of No 3 corn, average ear height and test weight are as shown in Table II.

The data in Table II points out the variation in corn plant characteristics for the 31 plots used in this study. It divides the plots into four groups according to ear shank diameters showing the relationship of this characteristic to the others. Special attention is called to the column showing the average yield, per cent of down stalks, and picker loss. A decided increase in corn yield is shown as the size of ear shank increases. A decrease of nearly one-half in the percentage of down stalks is pointed out between the large and small shank group. The loss from mechanical picking is reduced nearly 50 per cent for large shank over small shank varieties.

SUMMARY

Certain characteristics of the corn plant seem to have a direct relationship to and materially effect the corn loss when harvested with a mechanical corn picker.

These same characteristics show a direct bearing on the corn yield, those giving a low mechanical picker loss resulting in a higher yielding corn.

The ear shank diameter and the percentage of down stalks are the characteristics having the greatest effect upon the mechanical corn picker loss and also the yield as shown by this study.

There is a close relationship between the ear shank diameter and the percentage of down stalks as shown in Table II.

The ear shank diameter is considered the most important corn plant characteristic effecting mechanical corn picker loss. Its close relationship to the percentage of down stalks, its marked effect upon mechanical picker loss and yield, and the ease with which it can be applied in selecting seed corn are the major reasons for this choice.

Inasmuch as picking is the only principal operation in corn production yet to be generally mechanized, it is safe to predict that economic considerations will eventually dictate the use of machinery for this purpose. Also, it is not logical to expect that the drudgery of hand picking will be retained in agricultural practice

New Developments in Hay Driers[1]

By A. W. Clyde[2]

THERE are doubtless several developments in artificial hay driers with which I am not very familiar. This paper, therefore, is limited to two types of machines with which I have had some personal experience. These are the low-temperature conveyor type developed by J. H. Fulmer of Nazareth, Pennsylvania, and the high-temperature rotary drum type, owned by The Pennsylvania State College.

Mr. Fulmer has been developing the conveyor type machine for several years and using it commercially at the same time. He now has about 750 a of alfalfa, all of which is put through the drier. When necessary, it is operated day and night. The original machine will evaporate nearly 2 tons of water per hour. Its conveyor is 9 ft wide and about 192 ft long. In 1932 a smaller machine was built on the same principle and sold to a nearby farmer. Its conveyor is 8 ft wide and 105 ft long. The accompanying drawing shows the general arrangement of the new drier but will serve to explain both sizes. Gases from the furnace are diluted with air to a temperature of about 290 to 330 deg F. The fan forces them through a tunnel underneath to the end of the drier where dried hay is discharged. The gases then pass through the mat of hay five times in the small machine, the last time being through the green hay. It will thus be seen that the counter flow principle is used, that is, gases and hay travel in opposite directions. Green hay is first run through a cutter set for 1½-in cut and then carried by elevator into the drier. It is there formed into a uniform mat on the conveyor by an ingenious device. Both the thickness of the mat and the speed of the conveyor are adjustable. During the test made by us on the small machine, the conveyor traveled 2.87 fpm which kept hay in the drier about 36 min. The mat was about 8 in thick.

MAT-FORMING DEVICE AND GOOD THERMAL EFFICIENCY ARE FULMER FEATURES

Mr. Fulmer has made two distinct contributions to the conveyor drier. The first of these is the mat-forming device. One of the drawbacks in the past has been that the mat of hay would not be uniform. It was likely to have loose spots. Most of the drying air would pass through the loose spots, thus overdrying them and leaving dense spots still wet. It is hard to conceive of the conveyor drier being very efficient without overcoming this difficulty. The Fulmer mat former gives a very uniform mat and does it without attention.

His second contribution is good thermal efficiency or using most of the fuel for evaporating water. Our tests show thermal efficiency of at least 63 per cent for both driers using hard coal as fuel. Probably the large drier would have done still better had it not been required to dry the hay to less than 2 per cent moisture so as to permit very fine grinding. The good efficiency is probably due to the use of the counterflow principle and to the low temperature of the exhaust gases. The latter are only 30 to 35 deg above the outside air.

We have this year made tests of both the large and small Fulmer driers to find their efficiency and losses. The results were so nearly the same for each that only the large drier test is given here. It was not practicable to use a Pitot tube or airmeter to measure the flow of air, therefore, it was calculated from the amount of fuel burned and the temperature after taking water vapor into account. The moisture in the fuel was determined, but on the advice of H. G. Turner, of the Mineral Industries School, we took an average figure for ash to arrive at the heating value of the fuel. He believed that would be more accurate than depending on a few small samples. Buckwheat hard coal averages about 14,900 Btu per pound of combustible. With 13½ per cent ash (dry basis) and 2.8 per cent moisture the higher heating value would be 12,500 Btu and the lower value 12,470 Btu per pound as used.

Test Data

Length of test	7½ h
Coal used per minute (buckwheat anthracite)	8 lb
Water evaporated per minute	59.1 lb
Water evaporated per pound of coal	7.39 lb
Thermal efficiency based on 12,470 Btu per pound of coal 1,100 Btu per pound of water	65.1%
Coal used per ton of dried hay	424 lb
Amount of dried hay per minute	37.6+ lb
Moisture in green hay (approximate)	62%
Moisture in dried hay (one test only)	1.2%
Average air temperature	66.7 deg F
Average temperature of air leaving fan	291.7 deg F
Average temperature of exhaust	96.8 deg F
Average moisture in outside air, per pound of dry air	0.00744 lb

Calculations

1. Heat supplied, 12,470 x 8 = 99,760 Btu per minute
2. Estimating 5 per cent loss from furnace leaves 94,770 Btu per minute available for heating air plus its vapor
3. Amount of heat needed to warm 1 lb of air plus 0.00744 lb water vapor at 225 deg — 225 (0.24+0.00744x0.46) = 54.76 Btu
4. Amount of air plus its vapor which could be heated to observed temperature, 94,770 ÷ 54.76 = 1730 lb. This is the calculated amount of dry gas (mostly air) going through the drier per minute.

Heat Balance

	Btu per min	Per cent of heat
Dry exhaust gases, 1730 x 30.1 x 0.24	12,500	12½
Water vapor in air, 1730 x 30.1 x 0.00744 x 0.46	180	Trace
Removed by hay, 37.6 x 100 x 0.42	1,580	1½
Radiation from furnace (estimated)	4,990	5
Radiation and leakage from tunnel and drier and unaccounted for (by difference)	15,510	16
Evaporating moisture from hay, 59.1 x 1100	65,000	65
Totals	99,760	100

The wet-and-dry-bulb thermometer showed that the exhaust gases were 100 per cent saturated. The total amount of outgoing moisture, however, figures 5 per cent more than saturation. The explanation of this might be that the green hay was causing some condensation, but the condensed moisture was being carried out in suspension. A member of the mechanical engineering department of Pennsylvania State College thinks this would be possible.

The 16 per cent loss from the drier attracts attention because of its size. Probably considerable of it was leakage. In the new drier the leakage was probably less but the radiation greater since the new drier is mostly uninsulated sheet steel. The test of the new drier gives some basis for figuring whether or not it will be economical to insulate it.

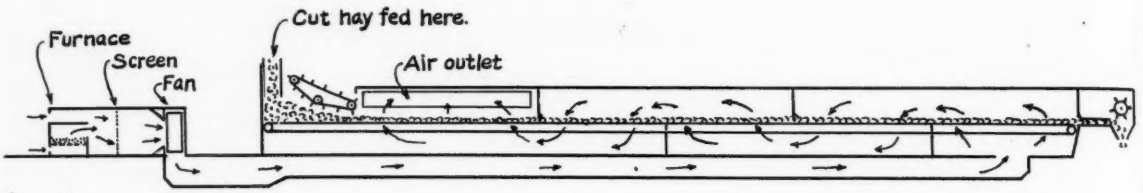
With our rotary-drum, high-temperature drier we have been trying this past season some of the things suggested in last year's report[3] for reducing costs. We have used thermocouples for getting temperatures of the gases leaving the furnace and of the exhaust gases. There are several practical difficulties to making a direct measurement of the gas flow through the drier. We have therefore been calculating it as described in last year's report. Fuel for each load of hay was weighed for much of the season.

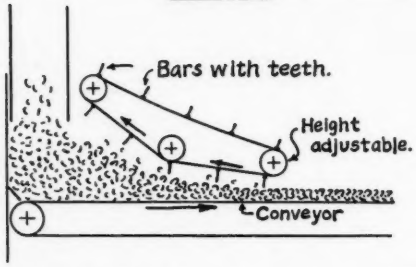
The first thing tried was reducing the flow of air through the drier by running the fan slower. The manufacturer's suggestion was a fan speed of 1350 rpm, but we used 1240 rpm mostly last year and from 1065 to 1100 rpm

[1]Paper presented at a meeting of the Power and Machinery Division of the American Society of Agricultural Engineers held at The Stevens, Chicago, November 1932. Publication authorized by the Director of the Pennsylvania Agricultural Experiment Station as Technical Paper No 575.

[2]Agricultural engineer, The Pennsylvania State College. Mem. A.S.A.E.

[3]AGRICULTURAL ENGINEERING, Vol 13, No 3 (March 1932).





(Above) This drawing shows the general arrangement of the Fulmer forage drier. (Left) A sketch of the mat-forming device used in the Fulmer drier

this year (1932). The idea was to circulate fewer pounds of air, get a lower exhaust temperature, and thus throw away less heat in the exhaust. We thought this might be done without reducing the capacity. It has been so difficult to hold all other conditions the same that we do not have definite proof of the effect of this factor alone. There is some indication of a little higher efficiency, but it is not conclusive. The reduced power needed by the slower fan speed is a gain, however.

When reduced air flow was combined with a higher initial gas temperature better thermal efficiency was at once apparent. In general we have cut the heat losses from 44 per cent last year to less than 35 per cent by using a hotter fire and keeping the slower fan speed. This has permitted a lower exhaust temperature and more capacity, or more water evaporated and more hay dried per hour. We can now evaporate over one ton of water per hour in this small machine, whereas last year we did not reach that figure.

In the following test, the same approximations were used as last year and results are given in the same form for comparison. Although this test was made on silage corn, the results have been fully as good with alfalfa.

Approximations

Heat value per pound of fuel oil (higher)	20,000 Btu
Hydrogen in fuel oil	13%
Water in fuel oil	1%
Radiation loss from furnace	3%
(Complete combustion of fuel because of large excess of air)	

Test Data

Length of test	7½ h
Weight green ..... 28,480 lb Weight dried	12,415 lb
Difference (considered as water evaporated)	16,065 lb
Rate of evaporation .... 1.07 tons per hour, or 35.7 lb per minute	
Fuel consumption	1315 lb, or 2.92 lb per minute
(Fuel about 7 lb per gallon at 60 deg F)	
Average temperature of gases leaving furnace	1451 deg
(or 1380 deg above air)	
Average temperature of exhaust gases	237 deg
(or 165½ deg above air)	
Average temperature ..... 71½ deg (dry); .. 64½ deg (wet)	
Average air humidity (moisture per pound of dry air)..0.01126 lb	
Temperature of dried product (approximate)	170 deg

Calculations for Gases Leaving Furnace per Minute

1. Water produced by burning H in fuel, 2.92 x 0.13 x 9 = 3.394 lb
2. Total water from fuel, 3.394 + (1% of 2.92) = 3.423 lb
3. Heat taken by water from fuel, 3.423 [(212 — 71½) + 970 + 0.48 (1451 — 212)] = 5,835 Btu
4. Higher heat from fuel, 2.92 x 20,000 = 58,400 Btu
5. Estimated radiation loss from furnace, 3% of 58,400 = 1750 Btu
6. Heat available for warming air plus its water vapor, 58,400 — (1,750 + 5,835) = 50,815 Btu
7. Heat needed to raise one pound of air plus its water vapor 1380 deg, 1380 [0.24 + (0.48 x .01126)] = 338.5 Btu
8. Amount of air plus its vapor which can be heated 1380 deg, 50,815 ÷ 338.5 = 150.1 lb

Adding 5 per cent for leakage gives 157.6 lb of air plus its water vapor entering the drier.

Heat Balance

	Btu per min	Per cent of heat of fuel
Dry exhaust gases, 157.6 x 165½ x 0.24	6,250	11
Water vapor in air, 157x.01126x165½x0.48	140	Trace
Water from fuel, 3.394 [1100 + 0.48 x (237 — 212)]	3,775	6½
Removed by hay, 27.6 x 100 x 0.42	1,160	2
Radiation from furnace (estimated)	1,750	3
Radiation from drier and unaccounted for (by difference)	5,625	10
Superheating moisture from hay, 35.7 x 0.48 (237 — 212)	430	½
Evaporating moisture from hay at 212 deg, 35.7 x 1100	39,270	67
Totals	58,400	100

Comparison with last year's test shows that the loss of heat in the exhaust gases has been reduced one-half, and the heat thus saved has been applied to useful work. Drying was also done 55 per cent faster.

Another thing having a vital effect on the cost of drying is the amount of water which has to be removed per ton of dried hay. Last year's report called attention to this and to the probable saving by letting hay wilt in the field if possible before artificial drying. For example, suppose we are going to obtain a ton of hay dried to 12 per cent moisture. One lot of hay is dried as soon as cut with 75 per cent moisture and another is allowed to wilt a few hours in the field to 60 per cent moisture. The 75 per cent lot will require the removal of more than twice as much water per ton of dry hay as the 60 per cent.

We now have rather conclusive proof that the fuel cost for the 60 per cent hay will be one-half of that for the 75 per cent hay. We have been able to select three loads of one and four loads of the other where all other factors including the thermal efficiency were very nearly the same.

	Three loads alfalfa (wilted)	Four loads alfalfa (not wilted)
Approximate moisture (%)	59½	74½
Thermal efficiency (%)	58.2	58.9
Fuel per ton water (gal)	27	26.6
Fuel per ton dried hay (gal)	31.6	64.8

This bears out the theory that a big saving in fuel can be made by using natural drying to help artificial drying. Probably field drying can be allowed to go still farther. The dairy department at Pennsylvania State College believes that the feeding value is not hurt by a moderate amount of it. At least there appears to be no loss of leaves until the moisture is below 50 per cent. Mr. Fulmer makes considerable use of field wilting whenever possible. The large saving in fuel which it gives is so obvious that I hope someone will soon learn what the practical lower limit is.

So many questions are asked about costs of drying that an estimate of operating costs of our small machine is given. Rather favorable conditions have been chosen, but they are entirely possible. They include thermal efficiency, 65 per cent; hay wilted to 60 per cent moisture; 1.2 h to evaporate 2400 lb of water giving 1 ton of hay at 12 per cent moisture, 8 h actually running and 1 h preparation, or 1.35 h total per ton of hay.

Cost Data for One Ton of Dried Hay

Fuel oil, 29 gal plus ½ gal for heating up at start, at 7c	$2.07
Labor, 3 men 1.35 h, at 40c, 30c, and 30c	1.35
Power, 17 kw for 1.2 h, at 3c	.61
Repairs estimated	.17
Operating cost per ton	$4.20

The overhead costs involves estimates of more doubtful accuracy. If only 150 tons were dried each year, the overhead might be as much as the operating cost.

Mr. Fulmer's operating costs are lower than ours mainly because his fuel cost (hard coal at $5.00 per ton) is only about one-half of ours and because the labor needed per ton is less on the larger drier.

We have not yet been able to eliminate the fire hazard in the separator used to separate the hay from the exhaust gases. When it clogs as it does a few times each season, we usually overheat and burn some hay. The hazard is that in a sack of hay the fire may smolder for some time unnoticed. If such a sack is put into a barn within a few hours, there is a serious risk. The fault is primarily in the separator rather than the drier, but it is one which must be eliminated or it will be a drawback to the high-temperature drier.

SUMMARY AND CONCLUSIONS

1. In thermal efficiency there seems to be no great difference between the conveyor and the rotary-drum driers. The slightly lower figure for the conveyor type shown by our tests could easily be made up by some insulation or reduction of air leakage. Probably the choice between the two should be governed by features other than efficiency in use of the fuel.

2. Progress in reducing the losses in the exhaust gases will be rather slow from now on unless these gases are used to preheat the green hay. The rotary drum needs a certain flow of gas to carry the hay through the drier. The Fulmer driers would not permit much less gas flow because that would mean a higher initial temperature with danger of charring the hay. Both types of driers use air as a medium to carry heat from the fire to the hay. Theoretically the hay could be heated without using air, but if that were done, there would be chimney losses from the furnace. A drier 100 per cent efficient and a furnace 65 per cent efficient would be no better than the combined outfit having an overall efficiency of 65 per cent.

3. There is still opportunity to reduce the cost of drying by reducing the losses of heat. Such progress may be rather slow because no single loss is very great. The main opportunities would seem to be

(a) Lower overhead cost by drying more tons per year, long-lived machines, or lower first cost.

(b) Lower labor requirement by more automatic operation. The present methods of handling the dried hay are often rather crude.

(c) Greater use of natural drying or wilting. The large saving of fuel which can be made by this method makes it apparently the easiest way to reduce costs. We still need, however, more information as to how far it can be carried before losing the advantages of artificial drying.

(AUTHOR'S NOTE: The author of this paper wishes to acknowledge the assistance of J. H. Fulmer, Nazareth, Pennsylvania, and J. B. Stere, D. C. Sprague, and H. N. Stapleton of The Pennsylvania State College in making the tests and preparing the equipment.)

Comparative Nutritional Values of Sun-Cured and Artificially-Cured Alfalfa Hay[1]

By L. M. Kishlar[2]

FOR THE past two years the Ralston Purina Company has been conducting extensive feeding tests to determine the relative nutritional values of sun-cured and artificially-cured alfalfa hays. Several agricultural experiment stations have reported the results of vitamin A determinations using albino rats as test animals, but so far as we are aware no reports have been made on feeding tests with farm animals. The object of this paper is to give the results of all the tests thus far conducted in the Purina biological laboratories in St. Louis and at the experimental farm at Gray's Summit.

Vitamin A tests have now been completed on six samples of alfalfa meals produced as follows:

1. By crusher-mower process, supplied by the University of California
2. By conveyor type drier using relatively low temperature, from Paul's Valley, Oklahoma
3. By pneumatic drier using relatively high temperature, Genesee Falls, Wisconsin
4. By sun-curing, from Lamar, Colorado. A commercial car purchased in the St. Louis market
5. By artificially curing, supplied by the U. S. Department of Agriculture, Iberia Livestock Farm, Jeanerette, La.
6. By sun-curing, supplied by the U. S. Department of Agriculture, Jeanerette, La.

It will be noted that Samples 1, 2, 3, and 4 were grown in four different states. Samples 5 and 6 were cut from the same field near Jeanerette, Louisiana, by a representative of the U. S. Department of Agriculture. Both samples were taken on the same day. The sun-cured hay was cured during clear bright weather with a relative humidity varying from 70 to 80 per cent. The artificially-cured sample was dried for 12 min at an average temperature of 255 deg (Fahrenheit). The maximum temperature of the drier was 350 deg.

Vitamin A tests on all these samples were run by the standard Sherman method. Albino rats depleted of their stores of vitamin A were fed samples of alfalfa meals in quantity to induce the standard unit gain of 25 gm in eight weeks. The results of the vitamin A tests were as follows:

Sample produced by	Vitamin A units per pound	
1. Crusher-mower process	1800	
2. Conveyor type drier	1750	
3. Pneumatic drier	1800	
4. Colorado sun-cured	1400	
5. U.S.D.A. artificially-cured	2000	cut from same field on same day.
6. U.S.D.A. sun-cured	2270	

The two samples of sun-cured hay were bright green in color. We have not run any tests on brown-colored hays, or hays badly bleached in drying.

DAIRY CATTLE

On September 16, 1931, fifteen Holstein heifers, twelve months old, were divided into three lots and placed on an exclusive ration of alfalfa meal. Up to the present time (November 1932) these heifers have received, in addition to the alfalfas, nothing except salt and water. Lot 1 is on a sun-cured Colorado alfalfa meal purchased on the

[1] A paper presented at a meeting of the Power and Machinery Division of the American Society of Agricultural Engineers held at The Stevens, Chicago, in November 1932.

[2] Ralston Purina Company. Mem. A.S.A.E. (The other authors who collaborated in the preparation of this paper are H. J. Smith, director of research; H. C. Schaeffer, biological chemist; and E. B. Powell, director of the research farm of the Ralston Purina Company.)

open market in St. Louis. Lot 2 is on meal from a low-temperature drier of the conveyor type purchased near Bryan, Texas. Lot 3 is on alfalfa meal from a high-temperature drier of the rotary type, near Greenville, Mississippi. The cows are allowed all the alfalfa they will consume.

For the year ending September 16, 1932, the average daily feed consumption per cow was 24 lb. There was practically no difference in the feed consumption in the sun-cured and low-temperature, artificially-cured hay, but the lot fed high-temperature hay consistently consumed about 2 lb per head per day, or about 9 per cent less feed than the other two lots.

No records of the water consumption of these cattle are available, but as soon as they were placed on test it was noticed that both the low-temperature and high-temperature alfalfas had a marked diuretic effect as compared to the sun-cured hay. This effect has continued up to the present time, so that it is necessary to remove the straw bedding from the stalls of the cattle on artificially-cured hay about twice as often as from the stalls of the cattle on the sun-cured hay. So far as we know the high water consumption has had no adverse effect on health. The hair coats of the cattle on the artificially-cured hay are a little rough, while the cattle on the sun-cured hay have sleek, smooth coats.

During the course of the experiment the cattle have been weighed regularly every four weeks. All three groups have grown at approximately the same rate. At times each lot has been a little heavier than the other two, but at no time has the difference in weights been significant. At two years of age and after being on feed for exactly one year the average weights of the heifers were as follows:

1. Those fed sun-cured alfalfa—1074 lb
2. Those fed low-temperature-cured alfalfa—1114 lb
3. Those fed high-temperature-cured alfalfa—1113 lb

Taking into consideration the number of heifers in each lot, the extreme difference of 40 lb between the averages is not significant. All three are significantly above the average of 841 lb which Professor Eckels of the University of Minnesota gives as the standard weight of two-year-old Holstein heifers.

SWINE FEEDING

On December 16, 1930, seventy-six shoats of our own raising were uniformly divided into four experimental pens. They were divided according to litters and sex, as well as to quality. All four pens were confined to dry lot. Two pens were fed exclusively on a meal ration containing 20 per cent sun-cured alfalfa meal. The ration for the other two pens was identical, except the sun-dried meal was replaced by low-temperature-cured hay. The sun-cured hay was Colorado alfalfa raised near Lamar, Colorado, and purchased in the open market at St. Louis. The artificially-cured hay was purchased at Paul's Valley, Oklahoma. The shoats were continued on test until June 2, 1931, a period of 168 days. The pens receiving the ration containing sun-cured hay consistently made more rapid gains, consumed more feed, and showed more finish throughout the duration of the test. The average daily feed consumption per pig for the entire 168-day period was, for those fed the sun-cured ration, 5.64 lb, and, for those fed the low-temperature-cured hay ration, 4.38 lb. The average daily gains per head for the entire period were 1.20 lb for the former lot, and 0.92 lb for the latter.

The total feed consumption per head was 948.3 lb on the sun-cured meal and only 735.9 lb on the low-temperature-cured meal. This difference in feed consumption and rates of growth were significant. It was not definite that the differences observed were due to real differences in the biological value of the meals, since there was a possibility that the differences in palatability might have been the determining factor. All ingredients for the two rations, other than the alfalfa meals, came from the same supply, and so far as can be determined there were no variables of consequence other than the hay meal.

In order to eliminate any possibility of differences due to the palatabilty of the two meals, a second test was run in which the rations were hand fed at the same level. This test was started on May 12, 1931. Thirty shoats of our own raising were uniformly divided into two experimental pens, care being taken to see that litter mates were properly distributed and that the sexes were evenly divided. Both pens were kept in dry lot during this test. Formulas for the two rations were exactly the same as in the previous test. For the first thirty days both pens received their rations in self-feeders. After that time they were hand fed three times daily at 5:00 a.m., 12:00 noon, and 6:00 p.m. Exactly the same amount was fed each pen, the amount being determined by the appetite of the pigs in the lot receiving the low-temperature process hay.

This test was continued until December 22, 1931, a period of 224 days. The average daily feed consumption for the pens were, for those fed the sun-cured meal, 4.85 lb per pig per day, and for those fed the low-temperature process meal, 4.87 lb per pig per day.

The average daily gains of both lots for the entire feeding period was 0.88 lb. A study of the daily gains of individual pens in the two pens showed that both lots were uniformly distributed with respect to variability of gains. The pens receiving low-temperature process meal showed 28.6 per cent of the pigs gaining over one pound per head per day and 71.4 per cent gaining less than one pound per head per day. The pens receiving sun-cured hay showed 30.8 per cent of the pigs gaining over one pound per head per day and 69.2 per cent gaining less than one pound per head per day. Our conclusions from these two tests were that the two meals were practically identical in biological value, but that the sun-cured hay was more palatable than the artificially-cured hay.

SUMMARY

In our work thus far we have not found any significant differences in the vitamin A content of sun-dried alfalfa hay and artificially-cured alfalfa hay. This opinion is based on the study of six samples of hay taken from five different states. Our tests have included hay dried by all the different artificial methods that have been proposed. Attention should be called to the fact that the samples of sun-cured hay used in this test were bright green in color. The New Jersey agricultural experiment station and the Indiana station have found that there were differences in the vitamin A content of artificially-cured alfalfa hay and sun-cured alfalfa hays which were bleached or brown in color. We believe that sun-cured hay, cut in regions where the weather is suitable for proper curing, is fully as rich in vitamin A content as the artificially-cured hay cut in the same region. The superiority of the artificial method of drying possibly will produce on an average better hays where weather conditions are not suitable for sun-drying.

Feeding tests with dairy cattle, in which the two types of hay are used as the exclusive ration, indicate that there are practically no differences in the biological value of the two types of hay. Artificially-cured hays, however, seem to promote a more copious flow of urine, but so far as we know this does not hurt the animal.

In two swine feeding tests it was noted that the sun-dried hay is somewhat more palatable than the artificially-cured hay, but when the two hays are fed at the same level their biological values appear to be identical.

The point of greatest interest to the agricultural engineer is the observation, consistent in all tests, that the artificialy-cured hay is somewhat less palatable to the animals than the sun-cured product. Animals fear fire and hate smoke. Animals can detect small smoky tastes or odors which we humans can not detect. Changes in design of driers to secure more indirect heat may be the solution to this palatability problem.

Power, Labor, and Fuel Requirements of Artificial Driers[1]

By Harold T. Barr[2]

THE problem of artificially curing forage crops is receiving an increasing amount of attention from agronomists, animal husbandrymen, engineers, and farmers. Agronomists and farmers see in such a process the possibilities of utilizing various crops and acreage which at the present time cannot be used profitably because of some condition, such as an excess amount of moisture during the harvesting season.

The animal husbandryman is interested in determining the effect this process may have upon the feeding value of the finished product. Chemical analysis alone is not sufficient proof of a superior feed, hence several agricultural experiment stations and various companies are conducting feeding trials to obtain accurate data on the actual feeding value of the artificially cured hay as compared to the ordinary field-cured hay.

Engineers are designing, building, testing, and improving machines to give a uniformly dried hay of an excellent aroma, color, uniform moisture, and maximum feeding value.

With the drier in operation the work may be divided into two distinct groups. The first has to do with cutting, loading, and hauling the green forage to the drier. The second relates to the power, fuel, and labor required in transforming this green forage into a dried feed.

The operations at the drier will be considered first in this paper. The fuel utilized in raising the temperature of the forage and driving off the excess moisture in the form of water vapor is the largest item of expense. Because of the wide variation in prices of fuel oil, coal, and power, no cost figures will be given. The ultimate goal, of course, is to obtain a maximum capacity at the lowest possible cost.

Fuel. Each drier referred to in this paper utilizes the complete product of combustion and brings it into direct contact with the forage to be dried. Apron driers utilize a lower temperature with a relatively longer exposure of the forage to the gases. One apron drier uses a temperature of 250 deg F with very good success. Rotary driers are using temperatures varying from 1000 to 1950 deg. With the Louisiana Agricultural Experiment Station drier this past season the lowest consumption of oil per 1000 lb of water evaporated was obtained when using a temperature of 1850 deg. Temperatures as high as 1950 deg have been used successfully on six-hour runs. The forage dried during these runs was from a very weedy patch of coarse soy beans containing 25 per cent water grass and 25 per cent indigo. No harmful effects as to color, odor, or apparent feeding value were produced by the high temperatures.

The data from our studies at the Louisiana station show that the fuel consumption, in pounds of oil per ton of dry hay, varied from 196 to 646 lb. This is the item which must be paid for in operating the drier; also it is the item which the engineer is interested in getting as low as possible. However, as various operators feed the green forage into the drier with initial moisture varying from 45 to 78 per cent, there is little wonder that there is such a wide variation in fuel consumption. With a green forage of 45 per cent moisture, 3,200 lb is required to give one ton of 12 per cent feed. Likewise, with a green forage of 78 per cent moisture, 8,000 lb of green forage is required to give one ton of 12 per cent feed.

The real test of a hay drier lies in its ability to drive off moisture by an economical use of fuel, while producing a high-quality feed. On the basis of heat units per pound of water evaporated, our data show that approximately the same efficiencies were obtained in the apron and rotary type of driers. With the Louisiana station drier, the lowest efficiencies were obtained at 1100 to 1200 deg F, and the highest at 1850 deg, on green forage crops. With the high initial heat the exhaust temperature was maintained very close to 240 deg. When the exhaust air was maintained at 240 deg, the dried forage showed a temperature of 198 deg. The dried forage was sacked and stacked in a sheet iron storage building at the drier. Taking readings from three sacks near the bottom of a two-ton stack, the temperature had dropped from 198 deg at 3:00 p.m. to 81 deg at 7:30 a.m. the next day, which was the same as the temperature in the storage building.

A graduate student in plant physiology was hired to make some studies of the cell structure of alfalfa before and after drying. This alfalfa was dried at a temperature of 1300 deg. He reported that microtone cross sections and longitudinal sections of the stems showed no evidence of cell-wall rupture.

Even though the utmost accuracy has been utilized in weighing and cleaning up around the drier, it has been found impossible to make the green weight and dry weight check with the per cent of moisture shown by chemical analysis. Some of this may be accounted for by fine particles lost through the exhaust air. One chemist has advanced the theory that some of the more volatile oils are carried off during the process of drying, because of the air currents in the drier which are not present during chemical analysis. The same results, with slight variations, have also been noted by Gordon[3].

A lower fuel cost per ton of dry hay can be obtained by securing a high efficiency in the use of the heat produced, and by allowing some wilting before bringing the forage to the drier. A drier capable of evaporating 4,000 lb of water per hour would give approximately 2 tons of dry hay from green forage with a moisture content of 55 per cent, while only approximately 0.8 ton of dry hay can be obtained from a green crop with a 75 per cent moisture content. Damp fields, frequent showers, and the fact that the soy bean crop was cut with a corn binder, prevented us from securing any appreciable amount of wilting during the past season.

Power. The power demand of several driers may be widely different, but when considered on the basis of useful work, such as kilowatt-hours per ton of dry hay, or kilowatt-hours per 1000 lb of water evaporated, one will show a very close relation to the other. With test figures available on only one apron drier and two rotary driers, the rotary driers show a much lower power consumption per 1000 lb of water or ton of dry forage. The apron drier figures include the power for operating a baler, while those for the rotary drier include the power of an elevating fan.

On the Louisiana station drier the power is divided as follows: Ensilage cutter, 10 hp; burner fan, 5 hp; revolving drum, 2 hp; elevating fan, 5 hp; exhaust fan, 2 hp; conveyor screw, 1 hp, and oil pump, 1 hp.

Labor. There are eight hay driers located within 150 miles of Baton Rouge—five rotary, one small apron, one large apron, and one modified Koon. There are also several pepper driers, and one or two partly built hay driers. The rotary driers each utilize one semi-skilled and 3 or 4 common laborers. The small apron drier uses one semi-

[1]Paper presented at a meeting of the Power and Machinery Division of the American Society of Agricultural Engineers held at The Stevens, Chicago, November 1932.

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[3]E. D. Gordon, associate agricultural engineering, Bureau of Agricultural Engineering, U. S. Department of Agriculture. Mem. A.S.A.E.

skilled and three common laborers (baling not included). While the large apron requires two semi-skilled and six common laborers. The modified Koon requires two semi-skilled and five common laborers. Our data on labor requirements shows an advantage in favor of the large apron type on 60 per cent forage; and about equal with the rotary type on higher moisture, when the rotary uses a very high temperature.

Gordon[3] reports that in drying lespedeza or Japanese clover a saving of 90 cents per ton was obtained by chopping and using a rotary drier, as compared to drying unchopped forage with an apron drier. He further reports that a considerable saving is obtained by using a combination of rotary and apron driers as compared to a rotary drier. A ton of dry hay with this combination required 6.4 per cent less power, 41 per cent less fuel, and 39 per cent less labor.

This work would tend to show the possibility of drying by a two-stage process, with a resulting saving in power, labor, and fuel.

A very short period of time elapses between the discharge of the partly dried forage from the rotary drier and its entry into the apron drier. A more efficient use of fuel might be obtained by allowing more time between driers, in order to allow for an equalization of the remaining moisture. However, there is not sufficient data at hand to discourage a continuous process. The best fuel efficiency with the Louisiana experimental drier was obtained by a continuous process at a very high temperature.

In visiting the various driers, the power, fuel, and labor used was found to be a very variable factor.

Field Power and Labor. In order to secure a complete picture of the total amount of power and labor used, we observed the cutting, loading, and hauling operations on an acre basis. How far green forage can be hauled to the drier is a frequent question. On an acre basis, the field operations required the following amounts of power and labor: Mowing, 0.70 tractor and 0.80 man-hours; loading (3 pitcher, 1 loader), 6.3 mule and 12.6 man-hours; hauling and returning to field 1¼ miles, 9.5 mule and 4.75 man-hours; unloading with fork by hand, 3.8 mule and 1.9 man-hours.

There are several things suggested by the results obtained during the past year. An increase in field efficiency is not justified if it causes a decrease in the drier capacity such that the labor and power per ton of dry hay is increased above the field gain. A more unified field and drier system must be obtained.

The results obtained with a two-stage drier suggests a more efficient possible use of the hot exhaust gases by utilizing them for preheating the green forage.

That different degrees of wilting are possible with each crop variety in order to secure the best quality of finished product at a minimum cost for power, labor, and fuel.

Not enough is known about the possible temperatures that may be used. With each temperature not only should efficiencies be obtained, but also the effect upon the feeding value of the dried crops.

(AUTHOR'S NOTE: The author wishes to acknowledge the help of A. W. Clyde, agricultural engineer, Pennsylvania State College; E. D. Gordon, agricultural engineer, Bureau of Agricultural engineering, U. S. Department of Agriculture; and William Whipple, professor of steam engineering, Louisiana State University.)

A Cooperative Farm Building Plan Service

By Henry Giese

Chairman, Structures Division, American Society of Agricultural Engineers

FOR A number of years the land grant colleges and universities in the central states have felt the responsibility of giving farmers assistance in the planning and construction of their buildings. This field has not proven profitable to the professional architect, and the farmer has perhaps lacked confidence in the plans prepared by commercial organizations interested primarily in the sale of building materials or equipment. The soundness of this feeling of responsibility is evidenced by the fact that the idea has grown until now each of 38 states and the U. S. Department of Agriculture maintain a building plan service. Along with this movement, a feeling has been growing among the farm structures engineers that this duplication of effort among the several states is, to a large extent, unnecessary and could by proper cooperation be largely eliminated.

The field of farm structures is too large and too involved to be handled completely and adequately by one man. Most farm structures engineers have specialized on one or more buildings. The plan herein announced has been endorsed by the Structures Division of the American Society of Agricultural Engineers, and capitalizes the best efforts of each state in the group in a cooperative or exchange plan service.

Several states have reported the need for a complete revision of their plan services. A recent study of hog house plans shows an average age of nine and one-half years since the last revision. Many of the present plans were not adequately detailed and few described sufficiently well to enable the prospective builder to select a design to meet his requirements.

Now, however, what is believed will prove a workable plan has been formulated and fifteen central and midwest states have cooperated in the preparation of a number of building plans, which can be used in the several states, and which can be endorsed by agricultural engineers and other subject-matter workers in those states cooperating. These plans have been selected in keeping with good housing practice and proper construction methods. Credit has been given to cooperating states. No obligation is placed upon any state to use the plans, nor will there be any restriction against distributing other plans than those included in the set mentioned.

Recently the Bureau of Agricultural Engineering, U. S. Department of Agriculture, has announced its willingness to assist the states by compiling and maintaining an exchange list of plans. Through this service, any state college may obtain from the Bureau vandykes of plans produced by the U. S. Department of Agriculture, or the states. It is expected that these newly prepared plans will be included in the exchange plan service.

In addition to the working drawings, there has been prepared an 8½x11-in loose-leaf descriptive catalog containing, for each building plan, a perspective drawing, floor plan, section, and short description. These are primarily for the purpose of more adequately describing the plans and are to be sold to county agents, teachers of vocational agriculture, lumber and materials dealers and other interested persons at $2.00 each for single copies, which represents approximately the cost of production and distribution. The sale of descriptive catalogs, as working drawings will be handled by the agricultural engineering departments of the various state colleges and universities as heretofore. At present the cooperating group includes the departments of agricultural engineering in the land-grant institutions of the following states: Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Wisconsin.

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture. Requests for copies of publications abstracted should be addressed direct to the publisher.

Home Storage of Fruits and Vegetables, F. H. Beach and E. B. Tussing (Ohio Agr. Col. Ext. Bul. 123 (1931), pp 11, figs 8).—Practical information is given on the requirements and equipment for the home storage of vegetables, apples, and pears, particular attention being given to the maintenance of proper conditions of temperature and humidity through ventilation and insulation. Cellar, pit barrel, and box storage are described and the last two illustrated.

Farm Fencing, J. B. Wilson and A. Carnes (Ala. Polytech. Inst. Ext. Circ. 136 (1932), pp 18, figs 18).—This circular presents practical specifications for fencing and fence construction for the various inclosures needed on Alabama farms. It deals with both wood and wire construction and gives information on the preservative treatment of fence posts.

O. S. C. 400-Hen Laying House, A. G. Lunn and W. J. Gilmore (Oreg. Agr. Col. Ext. Bul. 447 (1932), folder, figs 3).—Complete working drawings for this structure are given, together with practical information on its construction and a bill of materials.

Estimating Building Costs, F. E. Barnes (New York and London: McGraw-Hill Book Co., 1931, 3. ed., rev., pp XV+656, figs 252).—This is the third edition of this handbook. According to the author every section has been revised where necessary to meet changed conditions. The chapters on heating and ventilation have been entirely rewritten, and new chapters have been added on the insulation of buildings, storage silos and circular bins, concrete masonry, and cement gun work.

Fifteenth Census of the United States, 1930: Drainage of Agricultural Lands—Summary for the United States, 1929 and 1930 (Washington: U. S. Bur. of the Census, 1932, pp 32, map 1).—This summary presents some of the statistics relating to the drainage of lands for agricultural purposes in the 35 states for which organized enterprises were reported.

It indicates that nearly two-thirds of the lands in drainage enterprises in the United States are located north of the Ohio and Missouri Rivers. The lands of this section, excepting large swampy areas in Wisconsin and northern Minnesota, were generally in farms before drainage enterprises were organized. The data also show 67,927 drainage enterprises for the United States with an average area of 1,892 a. There are 66 such enterprises of 100,000 a or more, 4,273 of between 5,000 and 100,000 a, 32,532 of between 500 and 5,000 a, and 31,056 of less than 500 a.

According to the classifications there were 4,213 drainage districts, 62,707 county drains, 212 township drains, 41 state projects, 68 irrigation enterprises, 26 commercial developments, 655 individually owned projects, and 5 projects of undetermined character within the 35 drainage states.

The works completed to January 1, 1930, included 138,673 miles of ditches, 55,032 miles of tile drains, 6,540 miles of levees, and 444 drainage wells from which water was pumped in order to lower the water table and prevent damage from seepage and alkali.

Mechanization and British Agriculture ([Rothamsted Expt. Sta., Harpenden], Rothamsted Confs. No 14 (1932), pp 55).—This is the report of a conference held at the Rothamsted Experimental Station. It contains special papers and addresses on The Effect of Mechanization on Soil Fertility, by E. J. Russell (pp 7-16); Engineering Development and Possibilities, by J. E. Newman (pp 17-25); Combination of Live Stock with Systems of Mechanized Farming, by J. A. S. Watson (pp 26-30); and Summary of the Agricultural Problems Involved, by H. G. Miller (pp 51-55).

A Comparison of the Pollution and Natural Purification of the Connecticut and Delaware Rivers and the Brandywine Creek, L. R. Setter (New Jersey Stas. Bul. 545 (1932, pp 40, figs 18).—Pollution and natural purification studies on three eastern streams of different size are reported. The mean monthly average discharge of these streams during the studies varied between 145 and 12,300 cfs.

Eleven to 23 sampling stations were located on each of the three streams. Ten to 13 sampling stations on each stream were sampled daily, semiweekly, or weekly, depending on the importance of the sampling station. The results obtained showed that a 70 per cent reduction of B. coli organisms occurred in less than 20 hours of flow from all sources of pollution irrespective of the concentration of the organisms. At sources of pollution where the initial B. coli concentration was greater than 1,000 per milliliter, a 70 per cent reduction was observed in less than 10 hours of flow. At sources of pollution where the initial B. coli concentration was greater than 10,000 per milliliter, 85 per cent reduction was observed in 10 hours and 99.9 per cent reduction in 110 hours.

No increase in B. coli numbers beyond sources of pollution was observed on any of the three streams studied. The reduction of B. coli numbers in the streams studied is more rapid than reported observations on the Ohio and Illinois Rivers. The deoxygenation coefficient, K_1 at 20 deg C, varied between 1.46 and —2.1, depending upon the amount of sedimentation or scouring. If the factors of sedimentation and scouring are eliminated as far as possible, an average deoxygenation value of 0.18 is obtained on the three streams. The reaeration coefficient, K_2 at 21 to 23 deg, varied from a negative value to 1.5.

The general conclusion is that the death rate of B. coli organisms in a stream appears to be similar to the mortality of organisms subjected to disinfectants.

Pump Irrigation and Water Table Studies, H. E. Weakly (Nebraska Station Bulletin 271 (1932), pp. 14, figs. 5).—The first section of this bulletin reports costs and returns from pump irrigation at the North Platte Substation for the eight years from 1924 to 1931. Results for three years, 1924-1927, were previously reported in Bulletin 227. The second section reports the results of preliminary studies of variations in the water table as caused by pumping.

The Durability of Fence Posts, J. C. Wooley (Missouri Station Bulletin 312 (1932), pp. 8, figs. 4).—The results of experiments on the treatment of fence posts are reported, the different kinds of treatments being described. These included setting in gravel, charring, coating with carbolineum, applying two brush coats of creosote, two-hour open-tank creosoting, and five-hour double-tank treatment with creosote.

The results to date show that the serviceable life of some of the less durable varieties such as hickory, willow, cottonwood, birch, ironwood, sycamore, basswood, and persimmon may be increased three times or even more by the five-hour double-tank creosote treatment, but when the cost of this treatment is computed and the annual cost per post is considered they are more expensive than other types of available posts.

Species showing sufficiently increased service from treatment to make the process economical included white cedar, white oak, red oak, and black ash. During 1927, 166 posts were treated by the steeping process, using zinc chloride, 5 per cent solution, as one treatment and sodium fluoride, 3 per cent solution, for the other. In order to prevent stock from licking the treated posts and to prevent some leaching out of the preservative, the posts were given a brush coat of discarded crank case oil, and to one set of posts a coating of creosote paint was applied. Eleven different varieties of wood are included in the test. To date two failures out of 50 posts are shown in the zinc chloride treatment and 21 failures out of 50 posts in the sodium fluoride treatment. The cost of treatment per post with zinc chloride over the check post was 10.3 c. For the sodium fluoride all items of cost were the same except for the chemical which amounted to 0.0129 c, making a total cost per post for the treatment of 9 c.

Brief information also is given on growing fence posts on the farm, concrete posts, and steel posts.

Air Circulation and Temperature Conditions in Refrigerated Carloads of Fruit, H. M. Newell and J. W. Lloyd (Illinois Station Bulletin 381 (1932), pp. 157-224, figs. 37).—Data showing air circulation and temperatures observed in 18 carloads of apples, peaches, and strawberries shipped under various conditions are presented and discussed.

Cars without floor racks, when loaded with bushel baskets of apples, developed large temperature gradients in the bottom layers and large vertical gradients near the bunkers. Temperature gradients were small in the top layers of such cars and in the stacks near the middle of the cars. Cars of apples loaded on floor racks showed large vertical temperature gradients in all stacks and relatively small horizontal gradients in all layers. Average temperature drops were more rapid in cars equipped with floor racks than in cars without that equipment. Air circulation appeared more active in cars with floor racks than in those without them. The greatest difference in circulation appeared in the upward movement of air through sections of the lading near the doors. The chief value of floor racks appeared to lie in their ability to supply cold air to the sections of the cargo near the doors rather than in the promotion of free circulation along the floor. Refrigeration was more rapid and more uniform in a carload of apples packed in bushel boxes than in comparable cars of apples packed in bushel baskets.

In well-built refrigerator cars, when the lading has been thoroughly cooled, the ice supply can fall well below half the

maximum capacity of the bunkers without allowing an increase in fruit temperatures. This applies to cars with ice bunkers of about 10,000 lb capacity. The size and character of the lading, as well as its temperature, undoubtedly will influence the extent to which the ice supply can be depleted without causing temperature increases in the load.

Forced air circulation in a carload of peaches materially increased the rate of cooling of the fruit and decreased temperature gradients throughout the load. In carloads of peaches and apples both air movement and rate of cooling of fruit were greater when the lading was warm than after it had been cooled for several hours. Data concerning the effects of motion of a refrigerator car on air circulation within indicate that such motion does not necessarily affect the convection currents within the car.

Air movement through the load as a whole in strawberry cars appeared as active as in carloads of peaches and apples, but load velocities, or movements of air through the load, were lower in berry cars, probably because of larger air channels. Longitudinal and vertical air channels appeared to be necessary for maximum circulation in carloads of strawberries. Open centers in carloads of strawberries had no beneficial effects on air circulation and seemed to retard air movement through the bracing stacks.

Electricity on New England Farms, II, W. T. Ackerman (New Hampshire Station Bulletin 266 (1932), pp. 54, figs. 9).—This is a progress report of investigations on seven experimental farms in New Hampshire carried on by the station in cooperation with the National and New England Committees on the Relation of Electricity to Agriculture.

The analysis of total load developed by all the experimental farms shows 31.2 per cent to be very desirable, 48.3 per cent desirable, and 20.5 per cent undesirable in the effect on the power factor of central stations. The better quality of electric load on farms, i. e., developing the greatest kilowatt-hour use in midsummer, is particularly influenced by such factors as a greater balance of use on the farm than in the home, the use made of refrigeration in the house and for milk and other products, the use of the combination range, booster type water heaters and portable motors. This type of equipment accounted for 31.2 per cent of the total current used over the five-year period.

Equipment developing 20.5 per cent of the total load, and concentrated in the winter, comprised lighting and poultry farm appliances such as incubators and brooders. That part of the load having negative qualities, i. e., contributing even bulk without seasonal characteristics, is responsible for 48.3 per cent of the total and comprises the largest number of appliances.

During the height of experimental activities a maximum increase in current used of 853 per cent was made on one farm over previous records. The average increase in kilowatt-hour consumption for all farms ranged from 0 to 466 per cent but averaged 288 per cent for the five-year period. The average concentration of equipment was 65 per cent in the household and 35 per cent on the farm. In 1925, 36 to 280 kwh was the range in monthly consumption with an average of 141 kwh. By 1930 the average of all farms had reached 428 kwh.

The farm electric load is continuing to steadily and normally increase rather than decrease. The limits of use in the farm home are easily discerned, but the development of electric power in farm operations is considered as being only well started. Dairy and fruit farms have shown the most desirable characteristics from the standpoint of quality of load. Increased volume of use has in most cases benefited the farm operator by making him eligible to lower rates. The trend of the scheduled rates of the utilities has progressed steadily in a downward direction.

Standing demand charges per horsepower on portable motors have been found to discourage their use. Single meters with combination rates have proved more desirable to farmer and utility alike than the multimeter method.

The Effect of Frequency of Irrigation on Potatoes Grown in Mimbres Valley, New Mexico, D. W. Bloodgood (New Mexico Station Bulletin 205 (1932), pp. 28, figs. 3).—This report is based on five years' investigations, conducted by the station in cooperation with the U.S.D.A. Bureau of Agricultural Engineering, regarding the effects resulting from different frequencies of irrigation on potatoes.

Three fields of different soil types and at different locations in the valley, were used for the investigations. The soils are classified as the mound phase of Mimbres fine sandy loam, Mimbres silty clay loam, and Karro clay, respectively. Each field was divided into six plats, all of which received different numbers of irrigations during the season. Irish Cobbler certified seed potatoes were used throughout the investigations.

The irrigation water was supplied by centrifugal pumps from an underground water supply. All of the water was measured, over weirs, except in 1927. The furrow system of irrigation was used, and the plats were irrigated at 1, 2, 3, and 4-week intervals.

The yields of potatoes increased with the increase in number of irrigations and amount of water applied, up to nine applications. The results indicate that it is necessary to irrigate frequently to produce satisfactory yields. It is doubtful whether irrigations applied within two or three weeks of harvesting had much influence on the yield.

The highest average yield, 9,435 lb per acre, was obtained with nine irrigations applied at one-week intervals after about May 3, using an average of 24.6 acre-inches of water. The highest estimated average duty of water, 494 lb of potatoes per acre per acre-inch, was obtained with four irrigations, using an average of 12.2 in of water.

Soil type was an important factor, the fine sandy loam producing 74 per cent more marketable tubers with use of less water than the silty clay loam, the average yields being 8,692 and 4,988 lb per acre, produced with average annual applications of 14.6 and 17.8 acre-inches, respectively. With nine irrigations using 21.4 acre-inches of water, the sandy loam produced on the average 12,056 lb of potatoes per acre. Soil texture also affected the grade of the potatoes.

The frequency of irrigations and amount of water applied affected the grade of potatoes. As the frequency of irrigations and the quantity of water increased, the percentage of grade No. 1 potatoes increased and the percentage of grade No. 2 potatoes decreased. The highest average percentage of grade No. 1 potatoes was obtained from plats receiving from seven to ten irrigations.

Farm Mechanization Progress, (U. S. Dept. Agr. Yearbook 1932, pp 426-428, 433-455, figs 17).—This section includes papers on —Machinery Is the Best Means Yet Found for Controlling Corn Borer, by R. B. Gray (pp 426-428); Seed-Cotton Drying Proves Profitable; Two Types of Driers Used, by C. A. Bennett (pp 433-435); Remediable Physical Condition of Farm Often Hampers Use of Machines, by G. R. Boyd (pp 435-437); Tractor's Adaptation to Varied Farm Operations Rapid in Recent Years, by R. B. Gray (pp 437-441); Tillage Implements of New Types and Designs Used in Modern Farming, by C. A. Cumings (pp 441-445); Some Types of Harvesting Machinery Reach High State of Development, by W. M. Hurst (pp 445, 446); Eroded and Terraced Farms Require Special Methods and Machinery, by C. K. Shedd (pp 446-449); Rural Electrification Grows as Farmers Find New Uses for Electricity, by S. H. McCrory (pp 449-453); and American Machinery is Influencing Agriculture Greatly in Other Lands, by R. B. Gray (pp 453-445).

The Mechanical Harvesting of Cotton, H. P. Smith, D. T. Killough, M. H. Byrom, D. Scoates, and D. L. Jones (Texas Sta. Bul. 452 (1932), pp 72, figs 37).—This bulletin reviews the history and development of cotton harvesting machinery and reports the progress results of studies conducted over a period of five years at the station in the development of a cotton harvester as a tractor attachment equipped with smooth rubber revolving stripping rolls.

The results show that the slot-type stripper (sled) harvested in 1928 an average of 73.4 per cent of the cotton from 12 varieties tested. In 1929 when smooth revolving rubber stripping rolls were used, an average of 77.9 per cent of the cotton was harvested from six varieties tested. The tractor-mounted cotton harvester, developed by the station, which was equipped with rubber stripping rolls, one of which was yielding, harvested in 1930 an average of 88.6 per cent, but when improved in 1931, it harvested 91.1 per cent of the total yield of cotton from three varieties tested for the two years.

Improvements made in cotton harvesting machinery resulted in a considerable reduction of trash collected with the machine-harvested cotton. The homemade, slot-type stripper, used in 1928 collected 42.8 per cent of trash, while the Texas Station cotton harvester collected in 1931, 34.7 per cent trash for the same three varieties.

In harvesting trials with a number of varieties of cotton, it was found that many of the varieties were not well suited to harvesting by machinery. From the information secured by studying varietal characteristics, it was evident that a type of cotton with large storm-resistant bolls, a minimum of vegetative growth, and an early short fruiting period was necessary to get the highest efficiency from a mechanical harvester.

Breeding work to develop a variety of cotton to meet the requirements of mechanical harvesters indicates that satisfactory progress has been made.

Cotton harvested with the various types of mechanical harvesters was cleaned on special bur-extracting and cleaning equipment. When the machine-harvested cotton was cleaned before ginning, approximately 32.1 per cent of trash was removed. This left 67.9 per cent of cleaned seed cotton, in which a small amount of trash remained. In ginning, 4.7 per cent of trash was removed. The machine-harvested cotton in 1931, after being cleaned and ginned, had the same staple length as hand-picked cotton, and was only one-half grade lower than hand-picked cotton.

The cost of harvesting a bale of cotton with the one-row Texas harvester amounted to $3.08 as compared with $15.75 for hand-snapping. The cleaning and ginning charges on a bale of mechanically harvested cotton were $11 and for hand-snapped cotton $10.50. The slightly higher cost of cleaning and ginning the mechanically harvested cotton is due to the fact that an average of 100 lb more of machine-harvested cotton is required to make a 500-lb bale of lint. The total cost therefore of harvesting, cleaning, and ginning a bale of mechanically harvested cotton averaged $14.08, while a bale of hand-snapped cotton cost $26.25, showing a difference of $12.17 in favor of machine harvesting.

A complete list of the patents that have been granted on various types of cotton-harvesting equipment is given.

A Method of Estimating Ground-Water Supplies Based on Discharge by Plants and Evaporation from Soil: Results of Investigations in Escalante Valley, Utah, W. N. White (U. S. Geol. Survey, Water-Supply Paper 659-A (1932, pp V + 105, pls. [9], figs 29, map [1]).—The results of investigations in the Escalante Valley, Utah, of the influence of evaporation and transpiration on ground-water level are reported and a method of measurement described.

The method is based on the daily fluctuations of the water table. Altogether about 75 shallow test wells were put down in this area of ground-water discharge in fields of all kinds of native ground-water plants and in fields of naturally subirrigated alfalfa. The area chiefly studied comprises about 32,000 acres in the vicinity of Milford. Fluctuations of water levels in these wells were measured regularly with a steel tape, and on most of them automatic water-stage recorders were maintained for varying lengths of time. As a check, test wells were put down and equipped with recorders in areas outside the valley, including Beaver Valley in the neighborhood of Beaver, Utah, and Snake Valley and Lake Valley, Nev. The records obtained from these observation wells show that during the growing season there is a marked daily fluctuation of the water table nearly everywhere in fields of ground-water plants. Usually the water starts down at 9 to 11 a m and reaches its lowest stage at 6 to 7 p m. At 7 to 9 p m the water begins to rise and continues to rise until 7 to 9 a m the following morning. The maximum daily drawdown observed during the investigation amounted to about 1.5 in in greasewood and shad scale, 2.5 in in alfalfa, 3.75 in in salt grass, and 4.5 in in sedges and associated marsh grasses. The fluctuations do not occur in plowed fields, cleared lands, tracts of sagebrush, and tracts where the water table is far below the surface. In general they begin with the appearance of foliage in the spring and cease after killing frosts. They cease or are materially reduced after the plants are cut.

The water table rises sharply almost immediately after a rain in fields of ground-water plants during the growing season, even though the rain is light and affords no ground-water recharge. There is little or no rise of the water table after rains in cleared lands at any time or in fields of ground-water plants when plant life is dormant.

In interpreting the fluctuations of the water table in terms of water used by the plants, cylinders were driven near observation wells so as to inclose columns of undisturbed soil in the zone in which the fluctuations take place, and the rise and fall of the water table in the inclosed columns after the addition or subtraction of measured amounts of water were carefully noted. From these experiments the specific yield of the soils was determined. The amount of ground water discharged daily by the plants was then computed by the formula $q = v(24r + s)$, in which q is the depth of ground water withdrawn, in inches, v is the specific yield of the soil in which the daily fluctuation of the water table takes place, r is the hourly rate of rise of the water table, in inches, from midnight to 4 a m, and s is the net fall or rise of the water during the 24-hour period in inches. In field experiments the quantities on the right-hand side of the formula except the specific yield can be readily determined from the automatic records of water-table fluctuations.

Ground-water plants were raised in four tanks filled with soils of the types to which the plants are partial, provided with an automatic measured water supply, and otherwise equipped so as to duplicate as closely as possible conditions that exist in the field. A companion tank was provided for the vegetation tank to determine the discharge of ground water by evaporation alone. This tank was filled with bare soil of the same type as that in the corresponding vegetation tank, and the water table in it was maintained at similar depths. In this way the attempt was made to differentiate transpiration losses from evaporation losses. Daily fluctuations of the water table similar to those that occur in the field were obtained in the vegetation tanks. These fluctuations were correlated with the daily ground-water discharge as indicated by the measured water supply delivered to the tank. The amount of water required to produce a unit of weight of dry vegetable matter in the tanks was computed, and the coefficient of ground-water discharge thereby obtained was applied to the field on the basis of dry weight of vegetable matter produced per unit area. Four water-surface evaporation pans were kept in operation in order to have a common basis for comparison, a determination being made of the ratio between all ground-water discharge disclosed by the tank experiments and water-surface evaporation for corresponding periods.

The data obtained indicate that the key to the interpretation of the daily fluctuations of the water table in terms of ground water consumed by the plants lies in the specific yield of the soils in which the fluctuations take place and in the rise of the water table during the middle hours of the night, when the ground-water discharge is practically negligible and the hydraulic head induced by the daytime drawdown is about average for the 24 hours. The investigation indicates further that the annual growth put on by the plants is an index of the ground-water supply which they consume during the season.

Erosive Effects of Heavy Summer Rains in Southeastern Washington, W. A. Rockie and P. C. McGrew (Washington Col. Sta. Bul. 271 (1932), pp 8, pls 7).—In a contribution, based upon investigations by the station in cooperation with the U.S.D.A. Bureaus of Agricultural Engineering and Chemistry and Soils, the conditions and results of an individual storm of the type that is infrequent but damaging are described and illustrated.

The farm land within the area affected is typical of the Palouse country, and the soil was largely the Palouse silt loam. The washing off of the soil in summer-fallowed areas was found to have started, for the most part, within 15 ft or less from the ridge crest. Thus, water accumulating within a distance of 15 ft was sufficient, on many slopes, to cut the soil away to plow-sole depth. The washes generally widened down the slope. Several alfalfa fields were carefully examined, and on none of them could any marked evidence of soil washing be found.

Thermostatically Controlled Master Valves as Heat Controllers for Buildings, F. E. Goetz (Colorado Sta. Bul. 393 (1932), pp 24, figs 9).—Studies in three buildings on the campus of Colorado Agricultural College, of the action of thermostatically controlled master valves to ascertain their value as a means of controlling temperatures in buildings are reported.

It was found that the master controls maintained comfortable, even temperatures free of extremes at all times except during high winds. Night temperatures were kept down but never so low but that the buildings could be heated to day temperatures in less than three hours. Excess ventilation was materially reduced, thereby conserving considerable heat which would otherwise have been wasted.

Steam consumption was materially reduced, estimations indicating an average saving of about 44 per cent during the two test periods run on the buildings. A saving in fuel consumption was shown in spite of an increased load on the heating plant and lower average temperature for the season. The fuel saving under these conditions amounted to about 12 per cent, and not only paid for the entire equipment but showed a considerable profit on the investment.

Electric Hotbeds and Propagating Beds, F. E. Price and C. J. Hurd (Oregon Sta. Bul. 307 (1932), pp 29, figs 13).—A discussion is given of the construction and operation of electrically heated beds for starting vegetable plants for transplanting and for the propagation of plants and shrubs from cuttings.

The power consumption for outdoor electric hotbeds of fairly tight construction, with good drainage and covered with glass, is estimated at 0.5 to 0.7 kwh per square yard per day for fall and spring operation and 1.0 to 1.5 kwh for winter operation in western Oregon when maintaining a soil temperature of from 65 to 70 deg F.

The cost of heat to maintain a temperature of from 65 to 70 deg in a 6-by-6-ft electric hotbed was found to be $1.80 to $2.50 per month during the spring with electricity at 3 c per kilowatt-hour. The electric hotbed was found to have many advantages over the manure hotbed.

The installation of the electric soil-heating cable is done in the same way for a propagating bed as for an electric hotbed. A metal tray 30 by 40 in with a 200-w heating element strung open under the metal floor of the tray is recommended for small propagating bed or hot bed installation. This device is equipped with an adjustable thermostat and ordinary lamp cord and may be plugged into a 120-v outlet.

The power consumption for electrically heated propagating benches operated in a greenhouse maintained at an average temperature of 59 deg was found to be approximately 0.8 kwh per square yard per day by the bed held at 70 deg kwh and 1.5 by the bed held at 80 deg. Propagating beds constructed like electric hotbeds and heated with electric soil-heating cable during the winter months operated at temperatures approximately 10 deg less than the beds in the greenhouse with the same power consumption.

It was found that propagating benches should have 8 to 12 in of sand or other medium over the electric heating cable for good temperature distribution.

Book Review

"Irrigation Practice and Engineering, Volume 1. Use of Irrigation Water and Irrigation Practice," by B. A. Etcheverry and S. T. Harding, both professors of irrigation at the University of California, is the title of a book in its second edition and the first volume of a three-volume series covering irrigation practice and engineering; the other two volumes cover the engineering features of irrigation systems. This volume is limited almost wholly to irrigation practice in the United States. Its purpose is to present the essential features of good irrigation practice with sufficient material regarding the subject involved to support the principles as set forth. The treatment of irrigation practice in this volume is limited to the handling and use of water on the farm. Its chapter headings are as follows: definitions and conditions affecting irrigation, physical properties of soils, disposal of irrigation water applied to the soil, water requirements of irrigated crops, general water requirements, preparation of land for irrigation and methods of application, farm distribution systems, and the selection and cost of small pumping plants. The book is published by the McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. The price is $2.50 postpaid.

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The Modern Meaning of Reclamation

RECLAMATION, a traditional word, has come to embrace all phases of land improvement mainly engineering in character. In the popular mind reclamation suggests irrigation or drainage of new lands, a concept now unfortunate and largely unfounded, for the bringing in of new lands has practically ceased. Members of the profession may well take pains to dispel this popular fallacy, lest the unpopularity of acreage expansion be visited on those newer—and now predominating—forms of reclamation which protect the existing farmer in the retention of his soil, or assist him in wresting a living from it.

It is particularly important to establish a sharp distinction between the Bureau of Reclamation in the Department of the Interior, long associated with vast "projects," and the more prosaic reclamation work being done by the Bureau of Agricultural Engineering in the Department of Agriculture, notably that by the Division of Irrigation. This division has attacked the waste of water in transit and usage—about half the original diversion—and has cut this waste 25 to 50 per cent, adding that much to the certainty (or the hope) of making a living for farmers already on the land with nowhere else to go.

This division is developing sand and gravel traps which will reduce greatly the costs of canal maintenance. Economies in ditch cleaning and control of ditch vegetation are being worked out. Destruction of lands and homes by storm debris from the mountain sides is being combatted. Research is developing underground storage methods which assure larger and more dependable water supplies than surface reservoirs. All of this—and much more—dovetails into and supplements, rather than duplicating, the work of state agencies.

But perhaps most pressing in importance just now, though an old problem, is the sad task of financial rehabilitation for irrigation districts or projects set up in other days and by other agencies. Through a maze of technical and economic studies the Division of Irrigation arrives at classifications of lands which can be made to pay, with the amounts of bonded burden they can bear, and other classifications of lands marginal or submarginal. It brings economic salvation to the farmer who has a chance, ends the misery of the settler without a chance, and increases the salvage to the bond-holders.

With the known aversion of the present Secretary of Agriculture toward creating any new farm competition, it is safe to assume that any reclamation which he may authorize through his own department will be for the protection of existing farmers, and of existing investments. This should be made known to the public as promptly and widely as possible.

Money Mind vs. Creative Thinking

"OF COURSE it is absurd for us as a nation to vote huge appropriations to support a Department of Agriculture, and large sums to subsidize agricultural colleges to show farmers how to increase production, and then to tax industrial workers so as to raise funds to hire the farmers not to increase production. It seems clear that under present conditions our program of national economy should include drastic curtailment of expenditures for the support of the Department of Agriculture, and for all irrigation and land reclamation projects."

So closes last month's "Business Bulletin" of the Cleveland Trust Company. It would be unkind, as well as a waste of space, to point out all the false assumptions made to serve as premises leading to a naturally wrong conclusion. Suffice that irrigation and land reclamation of the "project" type have been pretty well stopped short; that they were carried on not by the Department of Agriculture but by the Department of the Interior; that for years "dirt farmers" and the present Secretary of Agriculture alike have opposed "projects" foisted onto the federal treasury by townsite promoters and politicians whose interests in agriculture was limited to the pork-barrel; and that (barring the supposedly patriotic "food-will-win-the-war" propaganda) both federal department and state colleges have stressed production economy and profit margin rather than volume of farm production.

Be it said in passing, too, with all respect to the need for government economy, that to propose curtailment of Department of Agriculture and state college leadership as a means of dealing with agriculture's present place in the body politic is of a piece with proposing that to abolish the federal reserve board would clear up our banking troubles, or that to discharge treasury personnel would wipe out the national deficit.

* * * * *

In refreshing and (it seems to us) constructive contrast is a recent interview in which Henry Ford uttered the epigram that "scarcity cannot create plenty." He also said, "Money . . . . is our natural conveyor system, but it is not moving. People hang onto money because they think it is wealth. But money is only the mover of wealth, and it is not moving. And those who claim to be experts in the management of the money machine do not seem to be able to make it move."

After exhibiting a steering wheel made of soy beans, Mr. Ford announced that the finish of his cars would be made of soy bean oil. Dwelling on his doctrine of decentralization for industry—"workers . . . having one foot on the land and the other in industry"—he went on as follows:

". . . . curtailment of production does not seem to me to solve anything. I grant that the American dinner table is not a sufficient outlet for the American farm. I would supplement the dinner table with the factory. It is the pressure of the surplus that is going to open up for the farmer his greatest market in factory demand. Industry is suffering from the ailment of job slackness. Agriculture is suffering from the ailment of market slackness. Bring them together and each will heal the other."

Swinging back to banking—it was shortly after he had been coaxed to become a Santa Claus for Detroit's demoralized banking structure—Mr. Ford said:

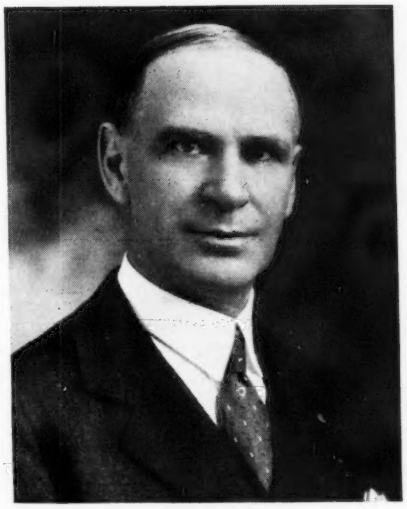
"We have had too much speculation in our banking system. People have thought that they could make money out of money. They thought they could live on money alone. That is the fallacy of the stock exchanges. . . .

The simple device of remembering that the deposit always belongs to the depositor, unless he otherwise specifies, would cure most of our banking abuses. You cannot get away from the retribution that comes when people misuse money—that is, try to make money only with money."

Regardless of the mistakes he has made—inevitable in a career of courageous originality—and passing over our differences with him on details of design, we believe agricultural engineers are at one with Mr. Ford in his vision of industry as a market for agriculture, and in his grasp of industry and agriculture as mere means to provide all good things for every family by efficient production and equitable exchange. And if his contempt for history be a fault, at least it has freed him from the feudal habit of mind which instinctively assumes serfdom to be the natural and proper condition of the dweller on the land.

The 1933 McCormick Medal Award

DR. J. BROWNLEE DAVIDSON has been unanimously selected by the Jury of Awards of the American Society of Agricultural Engineers as the 1933 recipient of the Cyrus Hall McCormick Medal.



J. Brownlee Davidson

Dr. Davidson has frequently been referred to, with justification, as the "dean of the agricultural engineering profession." A review of his many and varied contributions to the field of agricultural engineering bears abundant evidence of his qualifications to receive his highest award of the American Society of Agricultural Engineers.

Our society owes much to Dr. Davidson. He sent out the call for the first organization meeting held at Madison, Wisconsin, in December 1907. He is not only a charter member, but he was also the first president of the Society. He served as Secretary in 1910-11; Secretary-Treasurer in 1920; and, with President F. G. N. Kranick, he initiated the Society's technical journal, AGRICULTURAL ENGINEERING, in 1920. He served also as a member of the Council in 1910, 1913, 1914, 1921, and 1922. His devotion to the Society is borne out by the facts that he has missed but three of the twenty-six annual meetings held since the Society was founded.

Nebraska is the native state of this year's McCormick Medalist. In 1904 he was graduated from the University of Nebraska with the degree of bachelor of science in mechanical engineering. Later degrees from his alma mater are the professional degree in agricultural engineering in 1914 and the degree of doctor of engineering in 1931.

His professional career has been largely devoted to serving two great educational institutions, the Iowa State College (1905-1915 and 1919)—and the University of California (1915-1919). At present, Dr. Davidson is professor and head of the department of agricultural engineering at Iowa State College. In addition to his regular administrative and educational duties, Dr. Davidson has taken part in many professional activities, which include

1. Judge in the Winnipeg Motor Competition, 1909, 1910, 1911, and 1913.

2. Director of the Survey of Research in Mechanical Farm Equipment, sponsored by the U. S. Department of Agriculture, in cooperation with the National Association of Farm Equipment Manufacturers and the American Society of Agricultural Engineers, 1926 (while on leave).

3. One of the five members of the special committee of A.S.A.E. which interviewed President Coolidge at Rapid City, S. D., in August 1927, in behalf of the agricultural-engineering viewpoint on the agricultural situation.

4. Member of American Commission to Union of Socialistic Soviet Republics to study and report on a colonization project in the Far East, 1929 (while on leave).

5. Chairman of a special committee, appointed at the request of the National Association of Farm Equipment Manufacturers, to conduct an inquiry into changes in quality values of farm machines between 1910-14 and 1932.

A number of honorary and professional societies list Dr. Davidson as a member, as follows: Sigma Xi (science), Sigma Tau (engineering—national president, 1924-28), Phi Kappa Phi (science), Alpha Zeta (agricultural), Tau Beta Pi (engineering), and Gamma Sigma Delta (agricultural). He is also a member of the Iowa Engineering Society, and of the Society for the Promotion of Engineering Education, and he has represented A.S.A.E. on the Committee on the Relation of Electricity to Agriculture ever since its organization in 1923.

In addition to these society memberships, Dr. Davidson is active in the Ames Rotary Club, where doubtless his big identification button carries the friendly name, "J. B."

Many books, bulletins, and articles on agricultural-engineering subjects have come from the pen of Dr. Davidson. He is the author of three textbooks, the most recent being "Agricultural Engineering," published by John Wiley and Sons. He is editor of the agricultural engineering series of this publisher, which now includes seven texts. He was presented eleven papers at A.S.A.E. meetings, all of which are published in our Journal or Transactions. He is sole author of three Iowa Agricultural Experiment Station bulletins, and senior or associate author of fifteen other bulletins published by the Iowa or California stations. The Iowa integrating traction dynamometer, which is used by many scientific institutions, is evidence of his ability as a designer.

On the beautiful Cyrus Hall McCormick Medal appears the words "For Exceptional and Meritorious Engineering Achievement in Agriculture." When this medal is awarded to J. Brownlee Davidson at the 27th annual meeting of the Society at Purdue University, June 21-24, 1933, the members of the agricultural engineering profession may be assured that the inscription on the medal applies completely to their colleague who is receiving it.

JURY OF AWARDS

F. A. Wirt
O. W. Sjogren
O. B. Zimmerman
Wm. Boss
W. G. Kaiser
R. W. Trullinger
L. J. Fletcher (chairman)

PROGRAM OF THE 27th ANNUAL MEETING

American Society of Agricultural Engineers

Purdue University, Lafayette, Indiana—June 21, 22, 23, and 24, 1933

First Day — Wednesday, June 21

FORENOON PROGRAM — 9:00 to 12:00

COLLEGE DIVISION SESSION

Chairman Deane G. Carter presiding

1. Round table conference of Committee on Agricultural Engineering Education — Chairman C. O. Reed presiding.
2. Condensed reports of committees
   - (a) Cooperative Relations with Industries — J. B. Davidson, chairman
   - (b) Museum of Science and Industry—E. W. Lehmann, chairman
   - (c) Student Branches—V. R. Hillman, chairman
   - (d) Publication Standards—J. D. Long, chairman
   - (e) Agricultural Engineering Extension — E. G. Welsh, chairman
   - (f) Agricultural Engineering Research — H. B. Walker, chairman
   - (g) Relations with Vocational Education — J. P. Schaenzer, chairman
3. PAPER: "The Responsibility of Agricultural Engineers in the Improvement of Farm Mechanics Work in High Schools" — M. M. Jones, associate professor of agricultural engineering, University of Missouri
4. Business session

AFTERNOON PROGRAM — 2:00 to 5:00

COLLEGE DIVISION SESSION

Chairman Deane G. Carter presiding

1. ADDRESS: (Title to be chosen) — L. M. Sasman, state supervisor of agricultural education for Wisconsin
2. ADDRESS: "Education and Material Success" —Dr. George Brandenburg, head, department of education, Purdue University
3. Round table conference on agricultural engineering research—H. B. Walker presiding

EVENING PROGRAM — 6:00 to 9:00

1. (5:30) Dinner conference of agricultural-engineering department heads—Wm. Aitkenhead presiding
2. (6:00) Dinner conference of agricultural engineering extension workers — E. G. Welch presiding
3. (6:30) Student group session — student chairman presiding
4. (8:00) Joint conference of student group and faculty members

Second Day — Thursday, June 22

FORENOON PROGRAM — 9:00 to 12:00

GENERAL SESSION

President Charles E. Seitz presiding

1. Meeting called to order — Wm. Aitkenhead, chairman, Committee on Local Arrangements
2. Address of Welcome—Dr. E. C. Elliott, president, Purdue University
3. PRESIDENT'S ANNUAL ADDRESS: "Engineering and Rural Progress" — Charles E. Seitz, professor and head of the department of agricultural engineering, Virginia Polytechnic Institute
4. ADDRESS: "Trends in Engineering Education and Research" — A. A. Potter, dean of engineering, Purdue University
5. Fifteen-minute presentations of the three winning papers of the 1933 Agricultural-Engineering Student Papers' Competition

AFTERNOON PROGRAM — 1:30 to 4:00

STRUCTURES DIVISION SESSION

Chairman Henry Giese presiding

1. PAPER: "A Study of 100 Dairy Barns in Wisconsin" — M. A. R. Kelley, agricultural engineer, Bureau of Agricultural Engineering, U. S. Department of Agriculture
2. PAPER: "The Disposition of Drainage from Milking Barns in Metropolitan Districts" — H. B. Walker, professor agricultural engineering, and H. L. Belton, farm building technician, University of California
3. PAPER: "Dairy Corral Surfacings" — J. D. Long, assistant professor of agricultural engineering, University of California
4. ADDRESS: "A Philosophy for Rural Structures" — Wm. Boss, chief, division of agricultural engineering, University of Minnesota

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RURAL ELECTRIC DIVISION SESSION

Chairman T. E. Hienton presiding

1. SYMPOSIUM: "Electric Soil Heating"
   - (a) "Soil Heating Installations in Greenhouses of Middle West and East"—Richard Boonstra, agricultural engineer, Public Service Company of Northern Illinois, and M. W. Nixon, agricultural engineer, Cornell University
   - (b) "Field Soil Heating Installations"—B. D. Moses and J. R. Tavernetti, agricultural engineers, University of California, and H. L. Garver, agricultural engineer, State College of Washington
   - (c) "Heating Units and Equipment for Soil Heating"—R. R. Parks, agricultural engineer, University of Missouri
2. PAPER: "Problems in the Design and Construction of Farm Refrigerators"—J. R. Tavernetti, associate in agricultural engineering, University of California
3. REPORT: "Motor Control and Protective Devices" — A contribution of the Committee on Electric Motors—H. J. Gallagher, chairman
4. REPORT: "Experiments with Household Electric Equipment" — A contribution of the Committee on Household Equipment — P. B. Potter, chairman

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POWER AND MACHINERY DIVISION SESSION

Chairman W. Leland Zink presiding

1. PAPER: "Power Requirements and Effect on Cotton Yields of Seedbed Preparation Methods"—J. W. Randolph, agricultural engineer, Bureau of Agricultural Engineering, U. S. Department of Agriculture; J. O. Smith, agricultural engineer, Mississippi Delta Experimental Station; T. N. Jones, agricultural engineer, Mississippi Agricultural Experiment Station
2. REPORT: "Methods of Appraising Increased Values in Farm Machines"—J. B. Davidson, professor of agricultural engineering, Iowa State College

3. REPORT: A contribution of the Committee on Row Crop Investigations—R. I. Shawl, chairman

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LAND RECLAMATION DIVISION SESSION
Chairman James A. King presiding

1. SYMPOSIUM: "Land Reclamation Aspects and Relations of Recent Federal and State Government Programs
   (a) "The New Rural Credit Plan as Affecting Land Reclamation" — L. A. Jones, chief, division of drainage and erosion control, Bureau of Agricultural Engineering, U. S. Department of Agriculture
   (b) "The Farm Land Mortgage Plan as Affecting Reclamation" — (speaker to be chosen)
   (c) "The Federal Unemployment Relief Plan" — (speaker to be chosen)
   (d) "What the Agricultural Engineer Can Contribute to the Federal Administration Program" — S. H. McCrory, chief, Bureau of Agricultural Engineering, U. S. Department of Agriculture
   (e) General discussion of various methods by which land reclamation or conservation is affected, as (1) erosion control, (2) land clearing, (3) drainage, (4) irrigation, and (5) flood control

A.S.A.E. Annual Business Meeting — 4:00-5:00

EVENING PROGRAM

Committee and group meetings arranged by those interested

Third Day — Friday, June 23

FORENOON PROGRAM — 9:00 to 12:00

GENERAL SESSION
President Charles E. Seitz presiding

1. PAPER: "The Engineering Aspects of Home Economics" — Grace Pennock, household appliance specialist and editor, Delineator Institute
2. PAPER: "Can the Advantages of Machine Production in Agriculture be Retained?" — Walter E. Packard, agricultural engineer
3. PAPER: "Recent Developments in Farm Electrification" — George W. Kable, director, National Rural Electric Project

AFTERNOON PROGRAM — 1:30 to 4:00

STRUCTURES DIVISION SESSION
Vice-Chairman C. F. Miller presiding

1. PAPER: "Lightning Protection for Farm Buildings" — Stanley A. Knisely, director of research, National Association of Flat Rolled Steel Manufacturers
2. Reports of Committees
   (a) Farm Fire Prevention and Protection — H. E. Roethe, chairman
   (b) Grain Storage—F. C. Fenton, chairman
   (c) Farmhouse Standards and Design—Wallace Ashby, chairman
   (d) Coordination of Building Plans — W. G. Ward, chairman
   (e) Standards for Galvanized Farm Fencing —K. J. T. Ekblaw

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RURAL ELECTRIC DIVISION SESSION
Chairman T. E. Hienton presiding

1. SYMPOSIUM: "Uses of Light in Agriculture"
   (a) "Effect of Light on Animals" — Hobart Beresford, professor of agricultural engineering, University of Idaho. Discussion led by Kirk M. Reid, illumination engineer, General Electric Company
   (b) "Insect Control with Light"—L. S. Caple, rural service department, Rochester Gas & Electric Corp.
   (c) "Effect of Light on Plants"—R. B. Withrow, research assistant, horticultural department, Purdue University
2. PAPER: "A New Material for Wiring Farm Buildings" — J. D. Noyes, Detroit Edison Company
3. REPORT: "The Status of Electric Brooding"—A contribution of the Committee on Electric Brooders—Geo. W. Kable, chairman
4. REPORT: "Effect on Farm Customers of New Methods of Electric Metering" — A contribution of the Committee on Farm Wiring — H. S. Hinrichs, chairman

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POWER AND MACHINERY DIVISION SESSION
Chairman W. Leland Zink presiding

1. SYMPOSIUM: "Agricultural Engine Fuels"
   (a) "Present-Day Questions Relating to Motor Fuels"—(Speaker to be chosen)
   (b) "Results of Recent Fuel Studies with Farm Tractors" — A contribution of the Committee on Agricultural Engine Research—R. B. Gray, chairman
2. REPORT: "Results of Recent Tests of Pneumatic Rubber Tires on Farm Tractors" — E. E. Brackett, professor of agricultural engineering, University of Nebraska

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LAND RECLAMATION DIVISION SESSION
Chairman James A. King presiding

1. PAPER: "The Canvas Hose System of Irrigation" — George Amundson, extension agricultural engineer, Michigan State College
2. PAPER: "Operating Problems on Federal Irrigation Projects" — Geo. O. Sanford, chief, engineering division, Bureau of Reclamation, U. S. Department of the Interior

EVENING PROGRAM — 7:00 to 9:00

THE A.S.A.E. ANNUAL DINNER
Toastmaster Harry Bruce Walker officiating

1. Award of the Cyrus Hall McCormick Medal to J. Brownlee Davidson by President Charles E. Seitz
2. ADDRESS: George Ade, America's well-known Hoosier humorist

Fourth Day — Saturday, June 24

FORENOON PROGRAM — 9:00 to 12:00

GENERAL SESSION
President Charles E. Seitz presiding

1. PAPER: "Present Status of Development of Heat Insulation"—Russell Backstrom, insulation specialist, National Committee on Wood Utilization, Department of Commerce
2. PAPER: "The Economic Depression as a Challenge to the Agricultural Engineer" — Dr. J. Brownlee Davidson (1933 recipient of the Cyrus Hall McCormick Medal)
3. REPORT: "Status of Agricultural Engineering Development in Central Europe" — C. H. Dencker, head of department of agricultural engineering, Agricultural College, Berlin.

AFTERNOON PROGRAM — 2:00 to 6:00

Pilot T. E. Hienton in charge

1. Inspection trip to Coffing Brothers' 250-acre apple orchard at Silverwood, Indiana.
2. Technical program at orchard
   (a) PAPER: "Power and Labor Costs of Portable and Stationary Methods of Spraying" — C. L. Burkholder, horticultural department, Purdue University
   (b) PAPER: "Cooling Equipment for Cold Storage Houses" — C. I. Gunness, professor of agricultural engineering, Massachusetts Agricultural College
   (c) PAPER: "Equipment Designed for Orchard Tillage"—O. W. Sjogren, agricultural engineer, Killefer Manufacturing Corporation

A.S.A.E. and Related Activities

"Engineering Week" at Chicago

PLANS for the huge conference of engineers during "Engineering Week," June 25 to 30, at the Chicago Century of Progress Exposition, are making excellent progress. Engineers participating in the activities of this week will represent the membership of national engineering societies and associations. The American Association for the Advancement of Science meets in Chicago the week prior to Engineering Week. Every engineer or layman has an active interest in the scientific meetings which will be held during that week.

On Sunday evening, June 25, when Engineering Week officially gets under way, the International Union of Pure and Applied Physics will have a joint session in Section M of the American Association for the Advancement of Science. A number of the engineering societies will participate in this joint meeting with a program which is being arranged on the "Application of Physics" (especially to engineering) by Dr. R. A. Millikan.

On the evening of June 27, A. P. M. Fleming and H. Gough of England will address another similar joint session on "Industrial Developments of the Century."

In addition to the individual activities of all of the various groups during Engineering Week, there will be one huge joint assembly on Engineers' Day, June 28. The program for this day includes an assembling of engineers at the Fair Grounds at 9:30 a.m. At that time a program of the day's activities will be given each one present as well as an Engineers' Day badge. After this assembling period a visit to prepared scientific exhibits will begin under suitable guides and in a way to exemplify the exhibit from the engineering viewpoint. From 12:00 noon to 2:00 p.m. the engineers will again assemble at a strategic location and hear addresses by prominent scientists and engineers who will be visiting the city at that time. It is also hoped that arrangements can be made for a huge luncheon for all those present. In the afternoon the visiting of exhibits will again take place to allow those present to see more of the various exhibits which will be appealing to engineers in general.

The evening program consists of the great Engineers' Day banquet which is scheduled for the Stevens Hotel. Accommodations are hoped to be available for the actual seating of 2,500. With the possibility of using loudspeakers, an increased assemblage of 5,000 will be able to hear the addresses.

In addition to inspection trips to the many interesting educational exhibits at the exposition, engineers will also see much of value at the Sixth Midwest Engineering and Power Exposition to be held at the Coliseum during that week. At this exposition some 300 manufacturers will show the latest developments in steam and electrical generating equipment for power and processing purposes. In addition there will be a wide range of equipment such as pumps, heating and air conditioning apparatus, welded pipe and fittings, and many other items of particular interest to the engineer.

New Officers of Southwest Section

IN AN election conducted by mail the Southwest Section of the American Society of Agricultural Engineers have just selected the following officers for the coming year:

Chairman, R. W. Baird, associate agricultural engineer, Bureau of Agricultural Engineering, U. S. Department of Agriculture, who is connected with the federal soil erosion control project at Tyler, Texas.

Vice-Chairman, C. L. Osterberger, rural service engineer, Louisiana Power and Light Company.

Secretary-Treasurer, C. E. Ramser, senior drainage engineer, Bureau of Agricultural Engineering, U. S. Department of Agriculture, in direct charge of field work on the federal soil erosion control projects.

College Committee Election

AS THE result of an election just held, Ivan D. Wood, extension agricultural engineer, University of Nebraska, and R. H. Driftmier, head of the department of agricultural engineering, University of Georgia, were elected to serve two-year terms as members of the Advisory Committee of the College Division, American Society of Agricultural Engineers, beginning with the close of the next annual meeting of the Society to be held in June at Purdue University.

Personals of ASAE Members

Hobart Beresford is author of Circular No. 70, entitled "V-Belt Drives for Farm (Electric) Motors and Equipment," recently published by the University of Idaho.

W. G. Kaiser, who is a past-chairman of the Structures Division of the American Society of Agricultural Engineers, who was president of the Society in 1929-30, and who has played a prominent part in Society activities for the past sixteen years, was recently appointed manager of the cement products bureau, Portland Cement Association, Chicago. He entered the employ of the Association in 1917 as agricultural engineer, was later advanced to the position of chief of the farm bureau, and ten years ago was made assistant manager of the cement products bureau.

Chester O. Reed, professor of agricultural engineering, Ohio State University, was recently named by 31 out of 42 upper classmen as "the most interesting prof." Mr. Reed's many friends in A.S.A.E. will readily understand why he would be given such a complimentary designation.

O. B. Zimmerman, a past-president of A.S.A.E., and supervisor of materials and standards, engineering department, International Harvester Company, broadcast an address, entitled "The Engineer in Agriculture," over Radio Station WJJD at Chicago on April 2.

New ASAE Members

C. L. Burlingham, manager dairy division, James Manufacturing Company, Fort Atkinson, Wis.

John F. Charlton, appraisor, civil engineer, surveyor, and farmer, Box 2087, Fort Lauderdale, Fla.

Jerald E. Christiansen, junior irrigation engineer, Agricultural Experiment Station, University of California. (Mail) P. O. Box 393, Davis, Calif.

Joseph S. Webb, supervisor of rural sales section, Philadelphia Electric Company, 1000 Chestnut St., Philadelphia, Pa.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the April issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Elmer F. Clark, research fellow, department of agricultural engineering, Iowa State College, Ames, Iowa.

George M. Suda, blockman, John Deere Plow Company. (Mail) 828 Wisconsin St., Racine, Wis.